

# Fourth primary Science

Name: .....

Class: .....

## 1.1 Adaptation and survival

### **Some problems face the survival of living organisms in different habitats:**

1. Increasing or decreasing of temperature.
2. Shortage or plenty of water.
3. Food availability.
4. Shelter.

What are the factors affecting survival of living organisms?



## **Adaptation**

It is a way that helps the living organism to adapt and survive in its environment.

## **Bats**



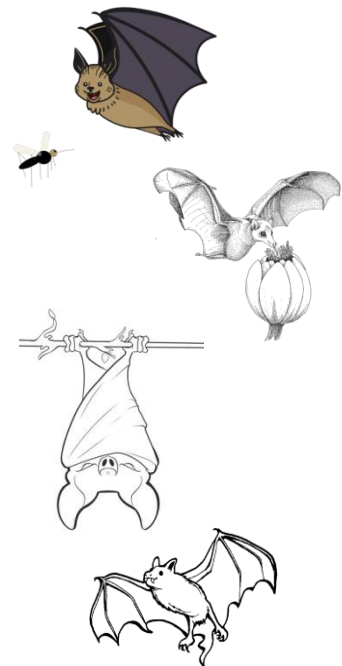
### **How do bats adapt to their environment?**

1. Most bats eat insects, as: mosquitoes.

2. Bats act as bees and butterflies in helping plants and flowers.

3. Bats hang (sleep) upside down.

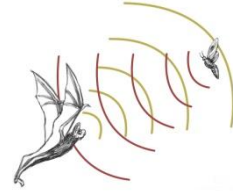
4. Although bats aren't birds, they can fly.



5. Bats are nocturnal animals.  
(i.e.: They are active at night.)



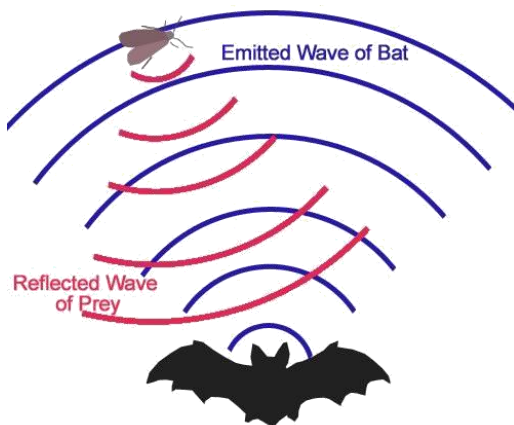
6. Bats use a technique, called "echolocation" to find their preys, as they can't see at night.



## Echolocation

It is a way that some animals use to find the location of things.

- Bats hunt for food in total darkness.
- Echolocation is important for them to survive.
- Bat produces sound.
- This sound travels through the air until it hits a surface.
- Then, it returns back to the bats' ears, causing them to hear.



## Life applications on Echolocation:



Vibrating walking stick inspired by bats

### Main idea:

- ✓ It produces very high sound like bats that can't be heard by the man's ears.

### How it works?

- ✓ The blind people use the vibrating walking stick during walking.
- ✓ The stick receives the echo.
- ✓ Then, the stick changes this echo into vibrations.
- ✓ The blind people feel these vibrations with their thumb.
- ✓ The vibration buttons can tell the human the direction of the objects and how far the object is from the person.



Think like a scientist.

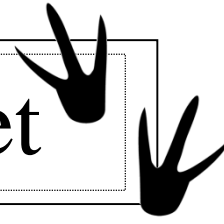


Mention a  
bat-like  
technology.

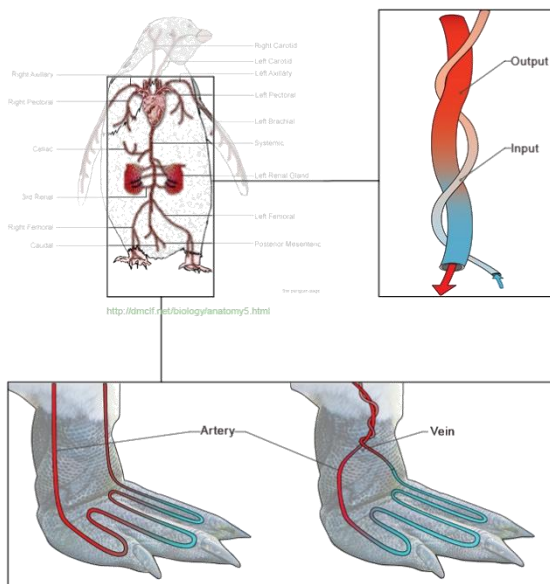


How did the scientists use the adaptation of an animal to design a new invention?

# Penguin's feet



- ✓ Penguins are cold-adapted for living in Antarctica where it is very cold.
- ✓ Penguin's feet keep warm due to the blood flow inside blood vessels within these feet.
- ✓ Penguins have specially arranged blood vessels which helps recycling their body's warmth, where:
  - a. Some blood vessels carry the cold blood from the feet.
  - b. Other blood vessels carry the warm blood found in the the rest of the covered body parts with fur **into the feet**.
- ✓ The blood vessels carrying the warm blood from the warm parts of the penguin's body coil around the other blood vessels carrying the cold blood from the cold feet.
- ✓ This lead to transferring of heat into the feet.



Penguin's feet work like a heat exchange system.



# Ways of adaptation

They are the properties that help the living organisms to survive (remain alive) in their environment.

## ☒ Examples:

### **1. Polar bear:**

- ✓ It has thick white fur to:
  - a. Keep warm.
  - b. Blend with snow to catch its prey.



### **2. Brown or black bear:**

- ✓ It has dark brown fur to:
  - a. Help it to hide between trees during catching its prey.



### **3. Caracal:**

- ✓ It is a mammal.
- ✓ It is a carnivorous animal (i.e.: eats meat).
- ✓ It has golden fur, to help it hide in desert.



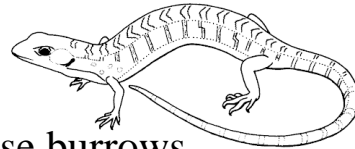
#### **4. Fennec fox:**

- ✓ It is the smallest of all the foxes.
- ✓ It has large ears.
- ✓ It has golden fur, to help it hide in desert.



#### **5. Lizards:**

- ✓ They have colourful scales that help them to hide between coloured rocks in the desert to:
  - a. hide from enemies.
  - b. catch preys.
- ✓ In very high temperature, lizards use burrows and go to shady places as a means of adapting to the desert heat.



#### **6. Bull shark:**

- ✓ It can live in fresh and salt water.
- ✓ It has countershading or dark coloration on top and light coloration on the underbelly.
- ✓ This helps the animal to blend into the water and catch their preys.



## 7. Chameleon:



Ways of adaptation	How it helps the animal?
1. Its body is covered with colourful scales.	Chameleons can hide between the green leaves and colourful flowers to catch their preys and hide from enemies.
2. They have V-shaped feet.	Chameleons attach to roots and branches of trees, spending all the night in hunting (catching) preys.
3. Tail.	Chameleons curl their tails to hold objects.
4. Eyes.	Chameleons can move each eye independently to watch two different things at the same time. This helps them to catch preys and hide from enemies.
5. Body and mouth.	Chmeleons can flatten out to appear bigger, then open their jaws widely ti scare their enemies.

❖ Animals live in different habitats, such as: polar habitat, desert habitar, ocean habitat, ... etc.

## Types of adaptation

1. Structural adaptation.
2. Behavioral adaptation.



P.O.C	Structural adaptation	Behavioral adaptation
1. Definition	A feature involves some parts of the animal's body (shape, body covering, ....)	Activities or behaviors that help an animal to survive.
2. Examples	<ol style="list-style-type: none"> <li>1. Thick white fur of polar bear to keep it warm.</li> <li>2. Large ears of fennec fox to listen for sounds of the prey in sand.</li> </ol>	<ol style="list-style-type: none"> <li>1. Birds migrate in winter to get food.</li> <li>2. A spider spinning its web.</li> <li>3. Hiding within sands or rocks to keep the body cool.</li> <li>4. Hiding in caves under the snow to keep the body warm</li> </ol>



Fennec fox	Arctic fox
1. It lives in dry desert climate.	1. It lives in tundra.
2. It has a pale brown fur, to help it hide in sand and to be protected from the sun rays.	2. It has thick white fur, to help it in hunting and catching its preys easily.
3. It depends on panting, to regulate its body temperature.	3. Its short ears and legs can keep it warm.

- ✓ Fennec fox has large ears to help it loss heat, to keep its body cold.
  - ✓ Both foxes eat all kinds of the found food, such as: insects, fruirs, plant roots and the remainig part of prey of another animal.
- Some animals are cold-blooded to survive in the environment.

## **Cold-blooded animals**

They are animals whose blood temperature changes with the temperature of air or water.

- **Examples of the cold-blooded animals:**
  1. Fishes.
  2. Snakes.
  3. Lizards.
  4. Chameleon.

## Evaluation

### **Q<sub>1</sub>) Choose the correct answer:**

1. Bats sleep (hang) .....  
a. on backs                      b. upside down                      c. upright
2. .... is a technique used by bats to know the location of the prey.  
a. Echolocation                      b. Adaptation                      c. Countershading
3. Bull shark can live in .....  
a. fresh water only                      b. sea water only                      c. (a) and (b)
4. Chameleons have .....-shaped feet.  
a. U                      b. V                      c. S
5. Caracal is a ..... animal.  
a. herbivorous                      b. carnivorous                      c. no correct answer

### **Q<sub>2</sub>) Write the scientific term:**

1. An animal that can hide from its enemies through countershading.  
[ ..... ]
2. An animal that has large ears to hear its preys on sand.  
[ ..... ]
3. A bat-like technology. [ ..... ]
4. A type of adaptation includes activities or behaviors that help an animal to survive. [ ..... ]
5. A type of adaptation includes changing some parts of the animal's body (shape, body covering, ....). [ ..... ]

### **Q<sub>3</sub>) Complete each of the following:**

1. .... can move each eye independently to watch two different things at the same time.
2. Chameleon has ..... Or dark coloration on top and light coloration on the underbelly.

3. Migration of birds in winter to get food is an example of ..... adaptation.
4. Bats are ..... animals.
5. Penguin's feet keep ..... Due to the blood flow inside blood vessels within feet.

**Q3) Give a reason for:**

1. Bats are important to the humans.

.....  
.....

2. Penguin's feet keep warm.

.....  
.....

3. Chameleon has V-shaped feet.

.....  
.....

**Q4) What happens when:**

1. The blood vessels carrying the warm blood from the warm parts of the penguin's body coil around the other blood vessels carrying the cold blood from the cold feet.

.....  
.....

2. A polar bear blend with snow.

.....  
.....

## Plant adaptation

- Plants grow in all the places reached by the Sun, even at the bottom of iced marine surfaces. These plants have the ability to adapt in their environment.
- Savannah is found in south Africa, where the temperature is moderate.
- Savannah faces severe shortage of water, during the drought seasons that last for half a year.
- Most plants can't overcome the drought, except Acacia tree.

## Two giant trees

(A) **Canopy acacia trees** adapts with the hot and drought habitats.

Way of adaptation	How it helps the tree to adapt?
1. Small leaves at the top of the trees.	a. It works like cover. b. It absorbs sunlight to make food.
2. Tap roots reaches to depth of 35 m.	a. To fix the tree. b. To reach to the underground water.
3. Trunk.	It stores water.
4. It is too long and has spines (thorns) around the leaves.	To stop the animals from eating its leaves, except the giraffes.
5. Leaves secrete poison.	To stop the animals from feeding on it, by making it taste badly.

## Notes:

>>The canopy acacia tree that was being eaten gave off a warning gas (bad scent) to neighbouring trees to start producing the same poison.

(B) **Kapok tree** grows in rainforests of Amazon in Brazil  
The height of these trees reaches to 70 metres.

Way of adaptation	How it helps the tree to adapt?
1. Palmately compound (hand-shaped) leaves.	To allow the wind to pass through them.
2. White and pink flowers make an odour.	To attract the bats which when moving from one flower to another facilitate the pollen.
3. They rely on wind.	To reproduce, because the wind blows the seeds away.
4. Large buttress root.	a. To support the plant. b. Fix the roots deeper in the sand and muddy soil.

- **Other examples:**

**1. Mangrove tree:**

✓ **Structural adaptations:**

Aerial roots (above-ground roots).

✓ **This trait helps the plant to survive, because:**

It helps the plant to withstand against waves.



## **2. Water lily:**

### ✓ Structural adaptations:

Upper surface of the leaf is covered with wax.

### ✓ This trait helps the plant to survive, because:

To keep the water away from the leaves.



## **3. Palm tree:**

### ✓ Structural adaptations:

Some of them have spines (thorns) on their leaves and trunks.

### ✓ This trait helps the plant to survive, because:

To protect themselves against animals.



## **4. Pine tree:**

### ✓ Structural adaptations:

Short branches and thorns instead of leaves.

### ✓ This trait helps the plant to survive, because:

To protect themselves against animals.



### **5. Acacia tree:**

- ✓ Structural adaptations:  
Very long roots.
- ✓ This trait helps the plant to survive, because:  
To reach to the deep underground water.



### **6. Prickly pear:**

- ✓ Structural adaptations:  
A lot of spines.
- ✓ This trait helps the plant to survive, because:  
To stop the animals from eating them.





## Evaluation

### **Q<sub>1</sub>) Choose the correct answer:**

1. .... of canopy acacia trees secrete (produce) poisons.  
a. Leaves                      b. Roots                      c. Trunk
2. Kapok tree has .....-shaped leaves.  
a. foot                      b. hand                      c. V
3. The ..... surfaces of the leaves of water lily plant are covered with wax.  
b. lower                      b. upper                      c. (a) and (b)
4. Chameleons have .....-shaped feet.  
b. U                      b. V                      c. S
5. Acacia tree has very long roots to .....  
a. reach deep underground water.  
b. keep the water away from it.  
c. protect itself from the animals.  
d. no correct answer.

### **Q<sub>2</sub>) Put (✓) or (✗):**

1. White and pink flowers of kapok trees produce and odour (smell) to let the bats go away from them. ( )
2. The upper surface of water lily leaf is covered with thorns to keep the animals away from it. ( )
3. The tap roots of Canopy acacia trees reach to the depth of 15 metres only. ( )
4. Mangrove tree has a very special type of roots, called aerial roots. ( )
5. The canopy acacia tree that was being eaten gave off a warning gas. ( )

**Q3) Give a reason for each of the following:**

1. Large buttress roots are very important for Kapok trees.

.....  
.....

2. The canopy acacia tree gave off a warning gas.

.....  
.....

3. The leaves of canopy acacia tree produce poison.

.....  
.....

4. Acacia tree has very long roots.

.....  
.....

5. Some pine trees have short branches and thorns instead of leaves.

.....  
.....

**Q4) What happens when:**

1. The upper surface of the water lily leaf isn't covered with wax.

.....

2. The prickly pear has no spines.

.....

3. Roots of Acacia tree are very short.

.....

4. Mangrove tree has no aerial roots.

.....

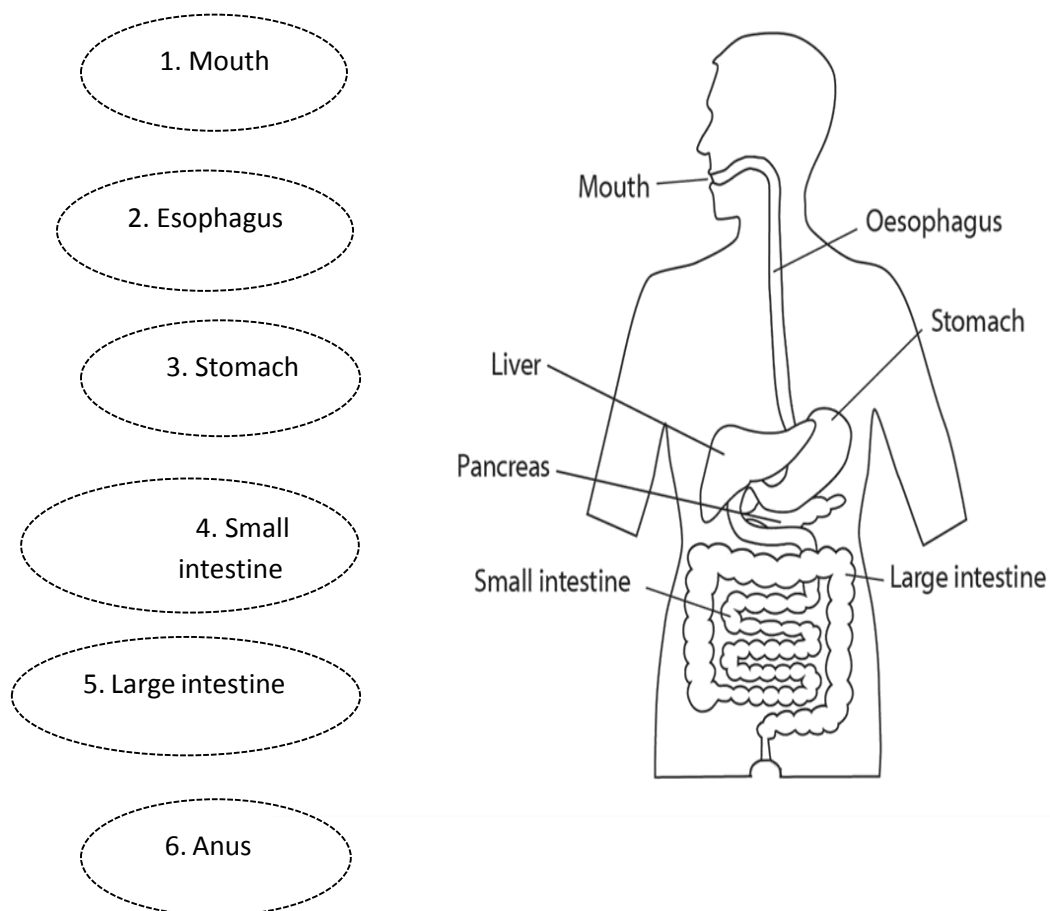
5. The canopy acacia tree can't produce a warning gas.

.....

## Human digestive system

- We eat food to give us energy needed to do several activities such as : walking, running, playing.....etc.
- Your body gets nutrients from the food you to do biological processes such as: heartbeats, respiration or lungs movement.
- The digestive system is responsible for digesting food and changing it from complex form into a simple one.
- Digestive system consists of a group of organs which help in digesting food.

### **Digestive system consists of :**



## 1. Mouth



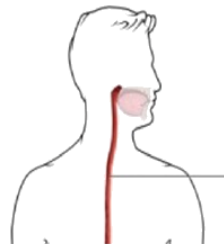
➤ The digestion process starts in the **mouth**.

The mouth consists of:

-**Saliva**: It softens the food to be easy to swallow.

-**Tongue and teeth**: They grind food and mix it with saliva.

## 2. Esophagus



\* A long tube which allows food to pass from pharynx to stomach.

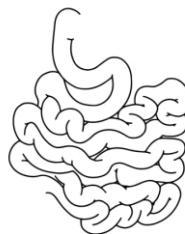
## 3. Stomach



➤ It mixes the food with the digestive juices.

➤ Food remains inside the stomach for hours till it becomes in a liquid for

## 4. Small intestine

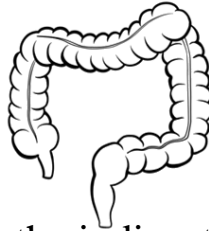


A long tube with **6 meters** long.

➤ Food is **completely** digested in the small intestine by the help of **digestive juices** secreted by liver and pancreas.

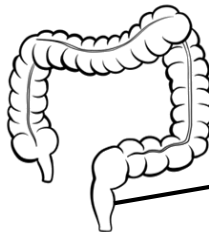
- Food changes into nutrients then it moves through very thin blood capillaries to reach the blood, then it is distributed to all body parts.

## 6. Large intestine



- It absorbs (take in) liquids from the indigested food which is then expelled outside the body through the anus opening.

## 7. Anus

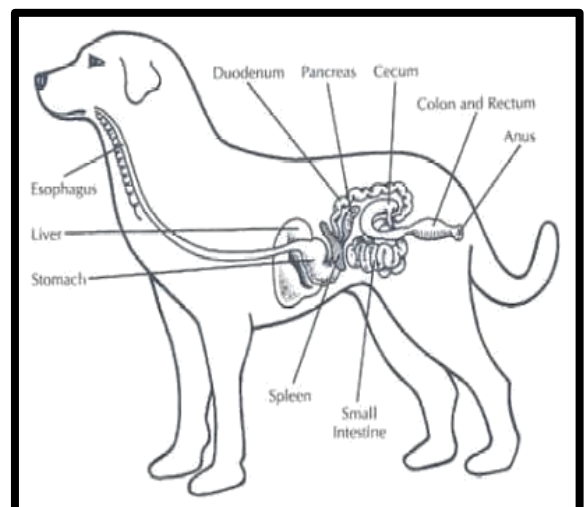
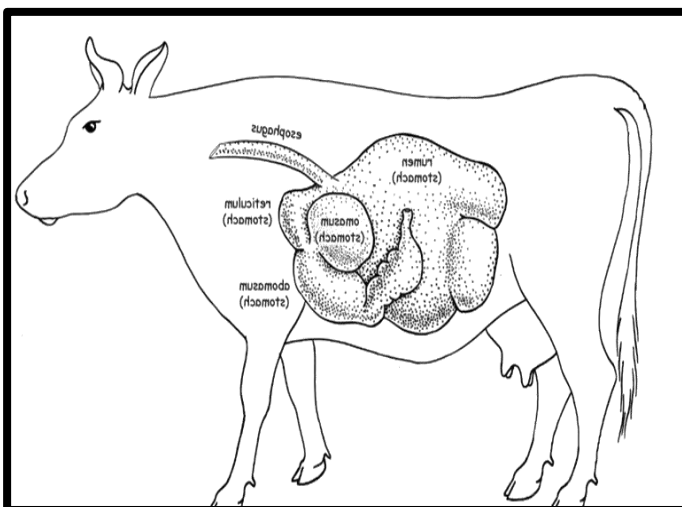


## 7. Anus

- An opening at the end of large intestine where the indigested food is expelled outside the body.

- ✓ Both animals and humans need nutrients to gain energy.
- ✓ The digestive system of some animals allows them to adapt according to the kind of food that they eat.

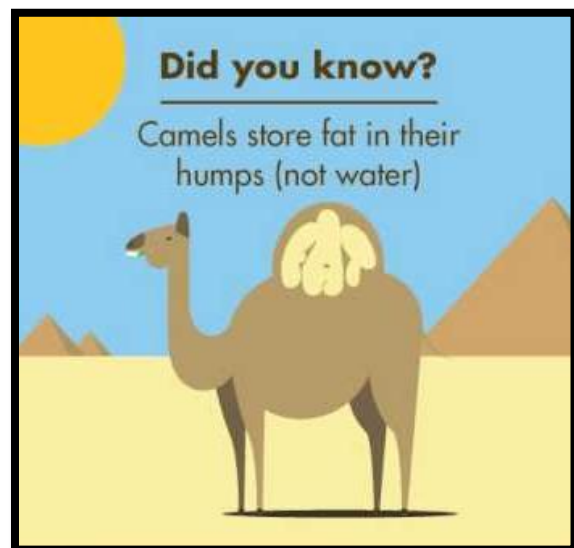
➤ **Look at the 2 figures then compare:**



<b><u>P.O.C</u></b>	<b>Cow</b>	<b>Dog</b>
Digestive system	<ul style="list-style-type: none"> <li>* Its digestive system is <b>long</b>.</li> <li>* It has <b>more than</b> one stomach to digest grass easily.</li> </ul>	<ul style="list-style-type: none"> <li>* Its digestive system is <b>short</b> and has <b>one stomach</b> because it eats meat.</li> </ul>
Teeth	<ul style="list-style-type: none"> <li>* It has <b>similar</b> teeth because it eats <b>grass</b>.</li> </ul>	<ul style="list-style-type: none"> <li>* It has <b>sharp</b> (pointed) teeth because it eats <b>meat</b>.</li> </ul>

### **How do camels store food for hours?**

- After they digest food, they store fats in their humps to adapt to the desert environment.



## Evaluation

### Choose the correct answer:

1. Digestion process starts in the.....  
a. mouth              b. stomach              c. esophagus              d. small intestine
2. The .....help in mixing and grinding food .  
a. Stomach              b. Tongue              c. Teeth              d. b and c
3. .... allows food to pass from pharynx to stomach.  
a. Small intestine              b. Mouth              c. Esophagus              d. Liver
4. The size of small intestine is about .....  
a. 6 meters              b. 60 meters              c. 6 cm              d. 60 cm
5. The ..... is responsible for absorption process.  
a. mouth              b. stomach              c. small intestine              d. large intestine
6. The ..... is (are) responsible for grinding food and mixing it with saliva.  
a. teeth              b. intestine              c. stomach              d. esophagus
7. The indigested food is expelled outside the body through.....  
a. anus opening              b. small intestine              c. large intestine              d. mouth
8. Dogs teeth are sharp because they .....  
a. eat grass              b. eat meat              c. drink water              d. a and b
9. Cows have straight teeth because they eat.....  
a. grass              b. meat              c. fish              d. a and c


**Q<sub>1</sub>) Correct the underlined words in each of the following:**

1. The digestive system of the dog has more than one stomach.  
[.....]
2. Digestion process starts in the stomach.  
[.....]
3. Saliva is responsible for grinding and mixing food.  
[.....]
4. Camels store food in their legs.  
[.....]
5. Food is completely digested in the stomach.  
[.....]
6. Small intestine is 60m long.  
[.....]

**Q<sub>2</sub>) Give a reason for:**

1. Dogs have sharp pointed teeth.  
.....
2. Presence of teeth and tongue inside your mouth.  
.....
3. Digestive system of cows is long and has more than one stomach.  
.....

**Q<sub>3</sub>) Mention the importance of each of the following:**

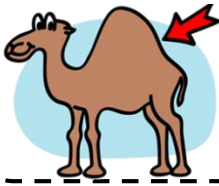
<p><b>1. Mouth</b></p> <p>.....</p> <p>.....</p>	
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## 2. Dogs sharp teeth



## 3. Camels hump



# Human respiratory system

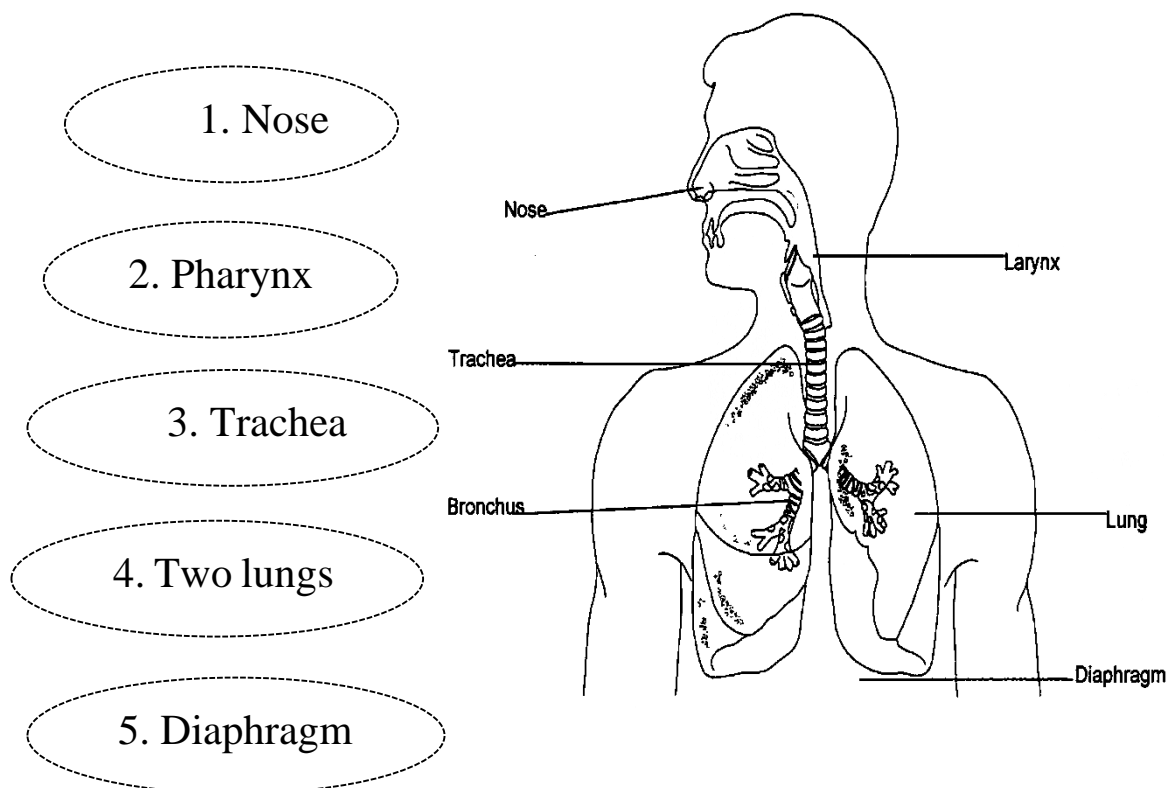
Our body needs **oxygen** from the air to be able to do different activities.

- **Oxygen** gas is very important to our body .
- The respiratory system is responsible for the **entry of oxygen** gas and **getting rid of carbon dioxide** gas.

## Respiration

A process by which a human body gets energy and oxygen from the air.

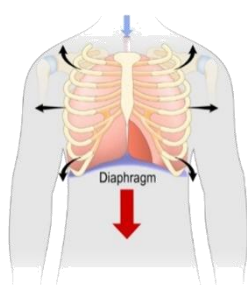
Respiratory system consists of :



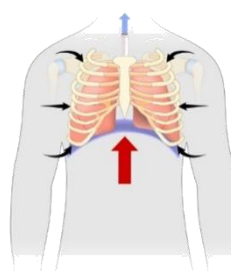
- The respiration process is a complicated process which depends on many organs.
- Each lung contains **bronchus** which is divided into **bronchioles**.
- Bronchioles end in tiny air sacs called **alveoli**.
- Alveoli have thin walls surrounded by **blood capillaries**, where the **exchange of gases** occurs.
- **Diaphragm** is a muscle that separates the chest (thoracic) cavity from the abdominal cavity and it helps in the mechanism of respiration process.
- The products of respiration process are **carbon dioxide gas** and **water vapor**.

➤ **Respiration process includes two processes which are:**

### 1. Inhalation process



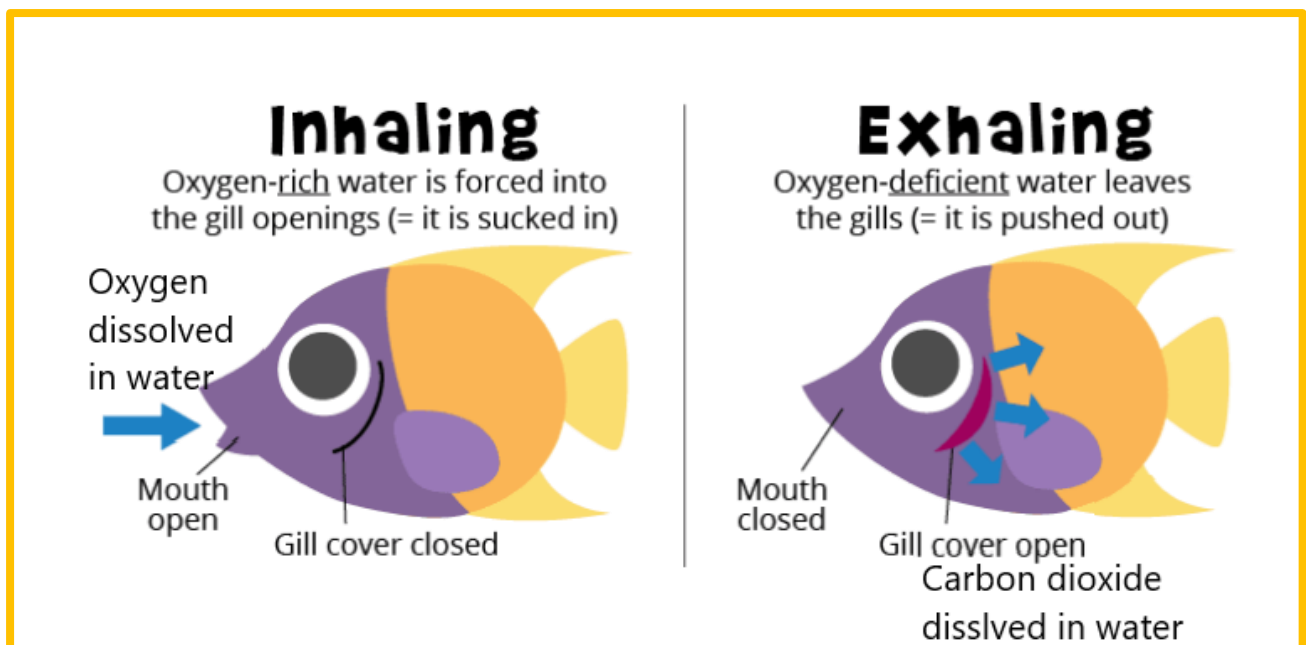
### 2. Exhalation process



P.O.C	Inhalation process	Exhalation process
Definition	A process by which the air rich in <b>oxygen gas</b> enters the lungs through the <b>nose</b> .	A process by which the air rich in <b>carbon dioxide gas</b> and <b>water vapor</b> is expelled outside the lungs through the <b>nose</b> .
Diaphragm muscle	It <b>contracts</b> and moves <b>downwards</b> .	It <b>relaxes</b> and moves <b>upwards</b> .
The ribs	Moves <b>upwards</b> .	Moves <b>downwards</b> .
Size of chest cavity	<b>Enlarges</b> in size .	Becomes <b>narrow</b> .

## How do fish breath under water?

- Fish use **gills** to take in oxygen gas and get rid of carbon dioxide gas.
- Gills are found at both sides of the fish's head, they open and close to allow gases in and out.
- Fish take in water from their **mouth** and allow water out from their **gills**.
- **Blood vessels** in the fish's body give blood to all body parts.
- **Gills** are considered an example of **structural adaptation** which allow fish to live, survive and breath under water.



P.O.C	Similarities	Differences
Digestive system of humans and fish	They both <b>take in oxygen gas</b> and <b>get rid of carbon dioxide gas</b> .	Digestive system in humans uses <b>lungs</b> while digestive system in fish uses <b>gills</b> .

## Evaluation

### **Choose the correct answer:**

1. During exhalation process ,the diaphragm muscle contracts and.....

- a. stays in place                      b. moves up                      c. moves down

2. Fish has gills which allow it to.....

- a. breath under water  
b. eat under water  
c. swim under water

3. A process by which human takes in oxygen gas and get rid of carbon dioxide gas is called.....

- a. inhalation  
b. exhalation  
c. digestion

4. A complicated process which depends on many organs.....

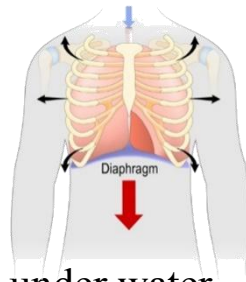
- a. feeding  
b. respiration  
c. swimming

5. During inhalation process, size of chest cavity.....

a. enlarges

b. stay the same

c. becomes smaller



6. Fish use.....to breath under water.

a. Lungs

b. Gills

c. Mouth

### **Complete the following**

1. ....muscle help in the mechanism of respiration process.

2. Respiration process includes.....process and.....process.

3. Exhaled air contains.....and.....

4. Diaphragm moves.....during inhalation and moves.....during exhalation.

5. ....gas is necessary for breathing.

6. Humans take in.....gas and get out .....gas during respiration process.

7. ....is a process by which living organisms can get oxygen and energy.

### **Compare between each of the following:**

1. Respiration in humans and respiration in fish.

2. Inhalation process and Exhalation process.

## Human effect on the environment

- Some changes may affect the ecosystem:

### (1) Natural changes:

- Temperature.
- Rainfall.
- Extreme weather conditions.
- Forests fires.
- Floods.



[This causes increase or decrease in the number of predators or that of preys]

### (2) Changes caused by human activities:

- Agricultural works, flattening of the land to build communities.
- Deforestation and soil dredging for agriculture.
- Swamp filling and removing sand dunes on beaches.



- The main results of the human activities:

#### (1) Air pollution:

It results from a large number of cars and factories that work in an improper way.

#### (2) Water and soil pollution:

Due to throwing garbage.



- **The human activities causing air and water pollution:**

- The human enters kinds of plants, animals and diseases to the environment that weren't exist before.
- This kind of changes stray origin types of plants and animals for many centuries.

**The polluted air, soil and unclean water cause:**

- The animals move from one ecosystem to another to get their needs and survive.
- Humans are affected if the crops don't grow, water is polluted or there is a difficulty in breathing because of the smoke.
- Humans have to change their life style and move to other places less polluted.
- A long exposure to pollution destroys our lungs and causes Asthma and heart diseases.

**Can the man return the ecosystem to its origin?**

Yes, if he:

1. replants the forests again and gets rid of pollutant factors for water and air.
2. saves the origin plants and animals.





## The relation between body systems and adaptation



### ❖ Small amphibians:

1. Examples: Frogs, toads and Salamanders.
2. Habitat: Desert habitat.
3. Needs: Water like human but in a different way.
4. They respire through the lungs as human, but they are able to take oxygen from water. (**How it happens?**)



Think like a scientist.



The body of the amphibians is covered with moist skin, that allows gas and water to pass through it.

## The role of scientific research in saving amphibians

You have learned that:

- Amphibians live in a moist environment.
- They need clean water, because the pollution destroys their natural habitat and they are highly sensitive to the effects of pollution and the presence of viruses inside the water.
- (ARC) project in Panama aims to saving and protecting frogs that live in rainforests and in danger of extinction by studying



the reasons of their disappearance with scary rates around the world.

The result of this project:

- 90 species (types) of amphibians throughout 20 years were exposed to extinction, in addition to 124 other species.

Try to help the scientists to solve this problem.



## Evaluation

**Q<sub>1</sub>) Choose the correct answer:**

- ..... is an example of the changes caused by the human affecting the environment.
  - Flood
  - Deforestation
  - Forest fires
- A Salamander is an example of .....
  - Amphibians
  - mammals
  - birds
- ..... pollution results from a large number of cars and factories that work in an improper way.
  - Water
  - Air
  - No correct answer
- A long exposure to pollution ..... our lungs and causes Asthma and heart diseases.
  - saves
  - strengthen
  - destroys
- ..... is an example of natural changes affecting our ecosystem.
  - Swamp filling
  - Removung sand dunes
  - Temperature

**Q<sub>2</sub>) Put (✓) or (✗):**

1. Water pollution takes place by throwing garbage in oceans. ( )
2. If the human replants the forests again and gets rid of pollutant factors for water and air, the ecosystem can return back to its origin. ( )
3. Rainfall is a natural change affecting the environment. ( )
4. Amphibians live in a dry environment. ( )
5. (ARC) is a project in Panama aims to saving and protecting frogs that live in rainforests. ( )

**Q3) Give a reason for:**

1. The body of the amphibians is covered with moist skin.  
.....
2. Animals move from one ecosystem to another.  
.....
3. Amphibians need clean water.  
.....
4. Water and soil pollution take place.  
.....
5. Air pollution takes place.  
.....
6. Natural changes affect the environment badly.  
.....

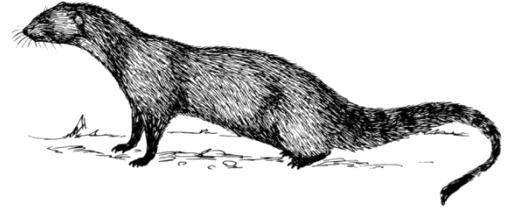
**Q4) Complete each of the following statements:**

1. .... is a project in Panama aims to saving and protecting frogs that live in rainforests.
2. Amphibians are able to take ..... from water.
3. A long exposure to pollution destroys our ..... and causes Asthma and ..... diseases.
4. ...., ..... and ..... are examples of amphibians.
5. The animals move from one ecosystem to another to get their ..... and survive.
6. .... and ..... are examples of natural changes affecting our environment.
7. .... and ..... are examples if changes caused by the human affecting the ecosystem.
8. Amphibians live in a ..... environment.

## 1.2 How do senses work?

How can Egyptian Mongooses communicate with each other?

- Egyptian mongooses chatter incessantly to each other, and combine discrete units of sound to communicate with another mongoose on moving from one place to another or searching for food and other important messages.



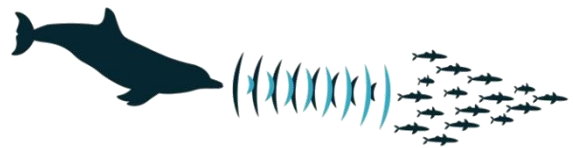
- Some animals see using their eyes, hear with their ears like what the human does.
- But, some animals have strong sense of sight or hearing or any other senses. They communicate with each other using sounds or movements.

### Super Capabilities of dolphins

- Dolphins have strong sensory organs. (G.R.F.)

To:

1. Survive.
2. Search for food.
3. Protect themselves under the water in darkness.



- Dolphins can use the sense of "echolocation" under the water, by which:
  - The dolphin produces high frequency clicks.
  - These clicks move through the water, then the sound waves return back to the dolphin.
  - So, echo is formed.

This helps the dolphin to know the place of its preys and the place of other objects.

## Using the five senses

- Humans and animals use their 5 senses to explore the world around them.

### Sensitivity in animals:

- My pet knows me through my smell.

Purpose	Sense	Examples
1. Avoid danger.	Sight, hearing, Taste	
2. Searching for food.	Smell, Sight, Touch	
3. Know friends.	Sight, Smell	
4. Know the objects.	Sight, Smell, Touch, Taste, Hearing	

- How do animals receive stimuli from the environment and how can they respond to such stimuli?

### Sensory response:

- ❖ Imagine that you're touching an ice cube with your finger.

Do you know in which part the information that tells you that this object is cold is processed? Circle the correct answer.

- (a) Index finger (b) Hand  
(c) Nerve endings (d) Spinal cord (e) Brain

- Seeing the objects at night differs from that during the day. The normal objects during the day seems a little bit strange at night.
- We can hear the sound, but it may be difficult to see clearly.

- The animal can know the place of its food (How..?)  
By hearing at night.
- Fortunately, the human spends most the day hours in doing his activities, so there is no need to search for food in the darkness.

- Nocturnal animals are active at night. (G.R)  
Because some areas may suffer from the very high temperature during the day and the animal go to search for food at night depending on darkness to surprise and catch their preys.

- How can nocturnal animal catch their preys at night without the need of light?

Animal	Sensory adaptations	Purpose (Use)
1. Snakes	- Using a certain part in the head.	To know the places of their preys.
2. Bats	- Echolocation	To know the places of objects.
3. Owls	- Super capability of hearing. - Rotation of the head in all the directions.	To know the weak and far movement and search for their preys.

- ❖ How can the animals respond to the sensory stimuli?

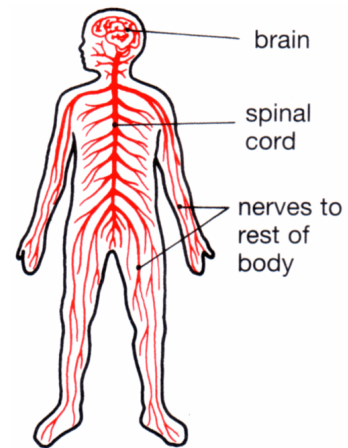
## Nervous system and pizza

- ❖ Imagine that you are standing outside the restaurant or the kitchen and you can't see the food. How can you know the type of food served to you?

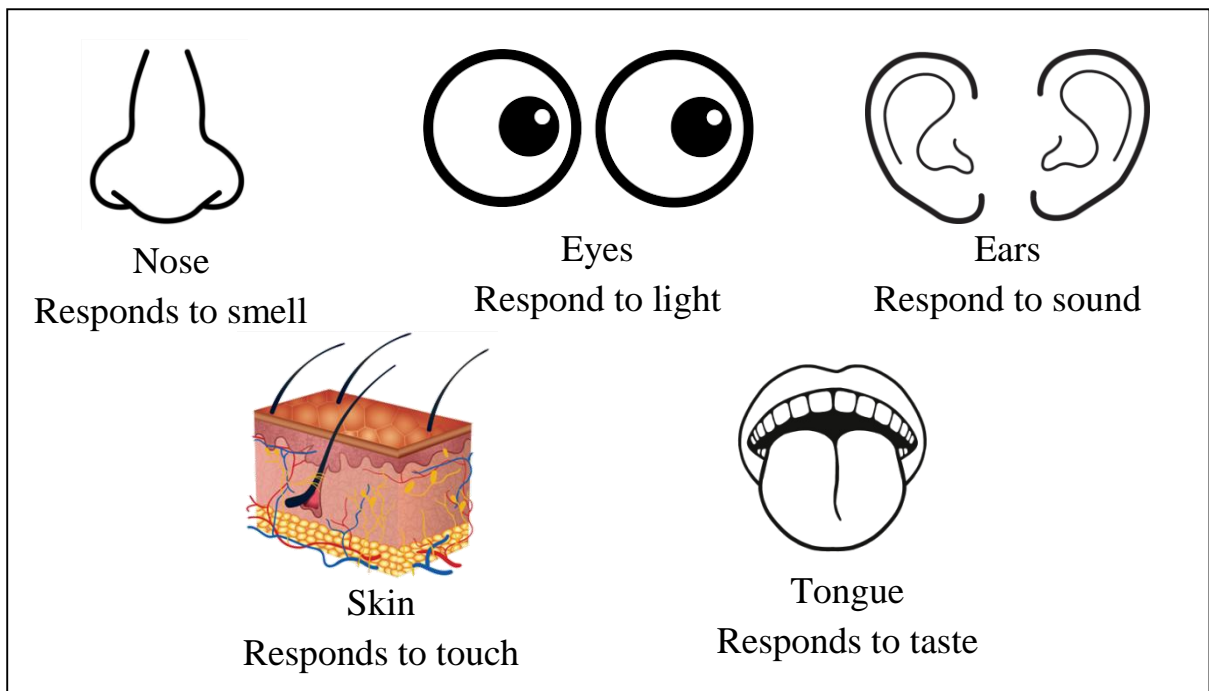
## Nervous system

- Nervous system of mammals (elephants, humans and dogs) consists of:

1. Brain.
2. Nerves.
3. Sensory organs.



- Humans use 5 sensory organs to respond to environmental changes, which are as follows:



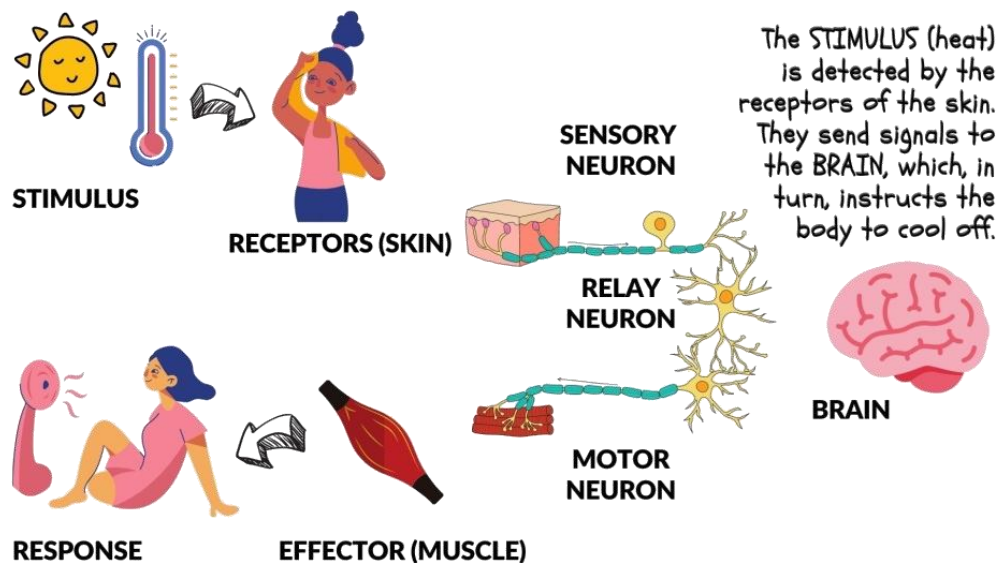
- The **nervous system** controls everything you do, including: breathing, walking, thinking and feeling.
- **Brain** is connected to a group of nerves passing by the backbone.
- **Spinal cord** inside the backbone sends signals between the brain and other body parts.
- Small nerves extend (emerge) from the spinal cord passing by all the body parts and are connected to the muscles and other body cells.



- **Some nerves** are connected directly to the brain, such as: eye nerves and heart nerves.

### How does the body respond to external stimuli?

1. Sensory organs receive the information from the environment.
2. The nerves connect the sensory organs with the brain.
3. The nerves receive the information from the sensory organs, then send the signals to the brain.



➤ **Example:**

When you smell the pizza:

- a. You receive this information through the nose.
- b. The nerves send this signal to the brain.
- c. The signal transfers in the form of electrical impulses through the nerves from the sensory organ to the brain to respond to it.

### Importance of the nervous system

1. It collects information.
2. It understands and interprets the meaning of this information.
3. It sends the signal to the body to do its mission.

## How it works?

- The **nervous system** collects information about what happens inside and outside the body, then sends it to the brain.
- **Sensory organs** are responsible for transferring information, such as: eyes, ears, nose, mouth and skin that are responsible for collecting data.

### Example:

When your ears hear sound waves resulted from bird chirps, the ear nerves carry a message to the brain to interpret it, then it sends this signal to the body to do the suitable action, such as:

(find the place of this bird on the tree)

The brain receives a message from the body, called **reflex action** (**reflexes**), that are fast, transfers to the body, then to the brain, such as: breathing signals.



### Do you know?

- The duration of the response to a stimulus differs according to the type of the used sensory organ.
- Example: Using sight helps me to hold the ruler better than using the sense of hearing.
- Dolphins and bats get their food by using echolocation to know the place of the prey.
- Sensory organs help the animals to adapt and survive in their environments.
- If they don't have sensory organs, they will die.

## Feeling the environment

Egyptian jerboa

A very small rodent.

- ✓ It has large ears.
- ✓ It is called the "jumping jerboa".

Organ	Modification
1. The legs like that of kangaroo.	- Jump 3 metres.
2. Hairy legs.	- Catch the sand and and jump in curved ways.
3. Large ears.	<ul style="list-style-type: none"><li>- Listen to the sound of predators, do it can escape quickly.</li><li>- It can feel the presence of snakes.</li></ul>

### How can the jerboa feel the presence of snakes?

- ✓ It can feel the presence of snakes.
- ✓ The sensory receptors transfers (moves) from the snakes to the ears of jerboa.
- ✓ Then pass through the nerves to reach the brain.
- ✓ The brain interprets this message, then orders the legs to start moving.
- ✓ This happens in less than a part of a second, and known as: "Response time".

### Response time

It is the amount of time that takes places between when we perceive something to when we repond to it.

## Evaluation

### **Q<sub>1</sub>) Choose the correct answer:**

1. The dolphins use the sense of hearing to be able to .....
  - a. search for food
  - b. protect itself under the water
  - c. know the location of things
  - d. all the previous
2. In places with very high temperature, the animals are active .....
  - a. during day
  - b. at night
  - c. in the morning
  - c. no correct answer
3. Some animals depend on total darkness to be able to .....
  - a. catch its prey
  - b. play with enemies
  - c. catch its enemy
  - d. watch T.V
4. Dolphins can know the location of things using .....
  - a. its tail
  - b. echolocation
  - c. its beak
  - d. all the previous
5. .... is (are) from the functions of the nervous system.
  - a. Collecting information
  - b. Sending signals to the body
  - c. Interpreting information
  - d. All the previous
6. Egyptian jerboa is a small .....
  - a. fish
  - b. rodent
  - c. snake
  - d. no correct answer

### **Q<sub>2</sub>) Complete each of the following:**

1. The legs of the Egyptian jerboa look like the legs of .....
2. The nervous system of mammals consists of the brain,  
..... and .....
3. Owls can rotate their heads in all ..... This helps them to  
search for .....
4. Egyptian jerboa can feel the presence of snakes with the help of its  
large .....

5. .... and ..... Are from the nerves that are connected directly to the brain.

**Q<sub>3</sub>) Correct the underlined words:**

1. A brain is a part of the respiratory system.  
[ .....]
2. The response time by which the Egyptian jerboa can respond to the brain signals is slow.  
[ .....]
3. The Egyptian mongoose sends sound messages with its neighbours on sleeping.  
[ .....]
4. The spinal cord runs inside the chest cavity.  
[ .....]
5. The reponse of the body to external stimuli is called response time.  
[ .....]

**Q<sub>4</sub>) Write the scientific term:**

1. It is the amount of time that takes places between when we perceive something to when we repond to it.  
[ .....]
2. The responsible organ for hearing.  
[ .....]
3. The main control centre of the nervous system.  
[ .....]

**Q<sub>5</sub>) Give reasons for:**

1. The nervous system is very important.  
.....  
.....
2. Egyptian jerboa can adapt to its environment.  
.....  
.....

## 1.3 Light and sight

### Hunting in the dark

Animal	Way of adaptation	Importance
1. Caracal	A special eye structure	Helps it to hunt at night and catch its preys easily
2. Fishing cat	A membrane behind the eye acts as a mirror.	It causes light reflection, so it provides the animal with a strong night vision to catch at night.

## Sources of light

### Light source

It is anything that produces its own light.

- ❖ Light source doesn't reflect light.
- ❖ It produces light only.
- ❖ Examples:
  1. Sun
  2. Candle
  3. Electric lamp

- It is difficult for the human to see at night, but the nocturnal animal do, because:
- (1) Some animals have different eye structures than the human. Nocturnal animals have larger eyes and wider eye pupils than ours.
  - (2) They have other strong senses, such as: hearing, smelling that help it to move and hunt at night.
- Examples:  
Tarsier monkeys.

Tarsier monkey

- A small monkey in Southeast Asia.
- Its height is about 10 cm. without its tail.
- It eats insects and lizards in dim light.
- It has two large eyes that collect the surrounding light then reflect it to form a clear image at night.
- Similarities between tarsier monkeys and owls in having large eyes, in which eyes can't move inside eye cavity. But it can rotate its head 180°.

# Adaptation at night

## 1. Human:

- Human needs a light source to see at night.
- Eyes don't allow the entrance of much light as it happens with cats and tarsier monkeys.

## 2. Cats:

- Eyes are more sensitive.
- Eyes accept larger amounts of light in comparison with the humans and this is due to the membrane found behind their eyes.

## 3. Tarsier monkeys:

- Eyes are large to see all the things.
- They rotate their heads 180 °C like owls .



## Light energy

### ❖ Vision:

1. It helps us to collect information about the surrounding environment.
2. Light helps us to see the objects.
3. Light is the only form of energy that we can see.
4. Light transfers as wave.
5. When the light falls on an object, it reflects to our eyes, so helps us to see.
6. Eyes transfer (move) signals to the brain to interpret them.
7. We see objects clearly in strong light.
8. We can't see the objects in the dark in the absence of light.
9. We can't see objects without reflecting light.

## Special eye structures

Q) What are the structures that the animals have, but the humans don't?

- Animals have special eyesight, called "Tapetum lucidum", which means "Light tissue".
- "Tapetum lucidum" is a way by which animals adapt to hunt at night.
- "Tapetum lucidum" is a reflective layer behind the retina, that reflects the light one more time towards the retina.

## Human sight

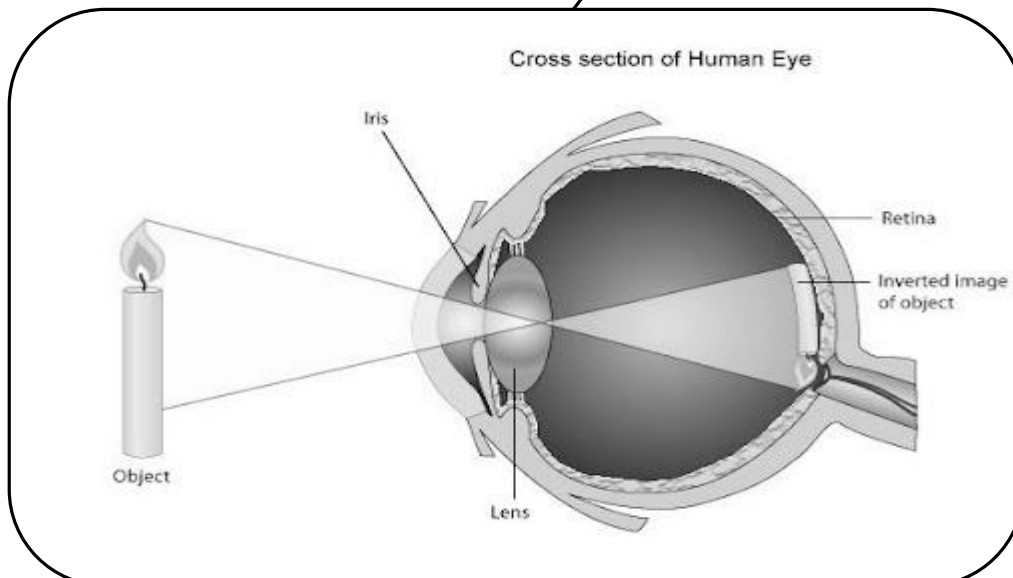
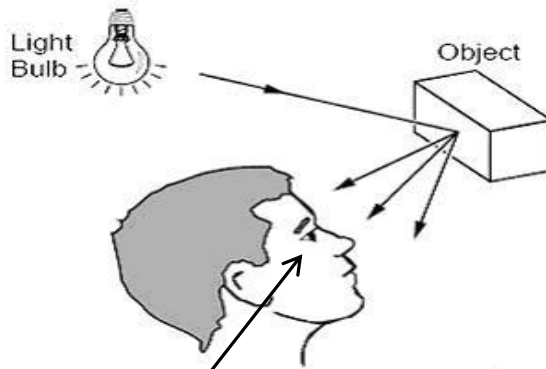
- The human see the objects by a very special structure, called "retina".
- Retina is a very delicate layer of tissues, sensitive to the light.
- It receives the light and transfer it to the brain in the form of messages, but at night, there is no enough light reaching the retina, so there is no information to be sent to the brain, for this reason, we can't see at night.

## Light reflection

**Light reflection:** is the bouncing (returning back) of light rays when light falls on a reflecting surface.

### How can you see things around us?

When light falls on objects, light reflection occurs and reaches our eyes then The light enters through the transparent layers of the eye and the lens focuses the light in the area inside the eye and converts the images into messages to the brain through the nervous system, so we see the body.



**The light reflection occurs in the presence**

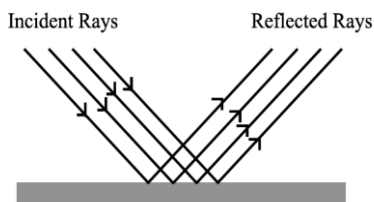
1- A source  
of light.

2- A reflecting  
surface.

**Types of light reflection:**

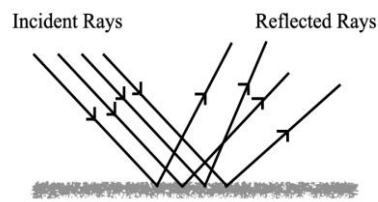
**A) Regular  
reflection.**

-It is the reflection of  
light when it falls on a  
**smooth and shiny  
reflecting surface**,  
where light rays are  
**reflected** directly in  
**one direction.**



**A) Irregular reflection.**

-It is the reflection of  
light when it falls on a  
**rough reflecting  
surface**, where light  
rays are **reflected and  
scattered in different  
directions.**



Examples of things that regularly reflect light:

- 1- Mirrors
- 2- Glass
- 3- Metals


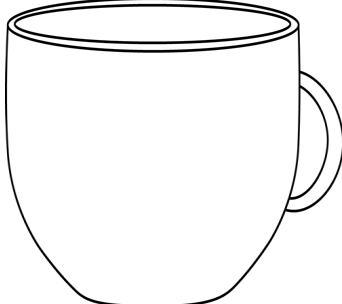
Examples of things that irregularly reflect light:

- 1- Paper
- 2- Wood
- 3- Fabric
- 4- plastic

When light falls on an object, it absorbs some of the light energy, and some of the energy may pass through the object or reflects.

Transmitting of light through different materials.

Materials can be classified according to the amount of light that transmits through them into:

Transparent materials	Opaque materials
	
The materials which allow <b>most</b> light to pass through and objects can be <b>seen</b> <b>Transparent materials</b>	The materials which <b>do not</b> allow light to pass through and objects <b>cannot be seen</b> <b>Opaque materials</b>
<b>Examples:</b>	<b>Examples:</b>

1-Clear glass. 2-Air. 3-Clear water. 4-Transparent plastic.	1-Rocks. 2-Carton. 3-Wood. 4-Aluminium foil. 5-Our bodies. 6- Books.
--	---

## Vision defects

- 1-The lens of the eye does not focus the light properly.
- 2-not seeing from a long distance.
- 3- Not seeing from a short distance.
- 4-Failure to distinguish between colors and difficulty in seeing the surroundings.

## Treatment

Wearing glasses, contact lenses or having laser surgery

## Evaluation 1-3

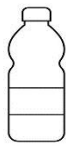
### 1- Choose the correct answer:

- 1) -----materials allow most light to pass through and objects can be seen clearly through them.  
a) Opaque  
b) Transparent
- 2) -----materials do not allow light to pass through and objects cannot be seen through them.  
a) Transparent  
b) Opaque
- 3) Which one of these objects do not allow light to pass through.

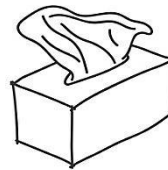
a)



b)



c)



- 4) A mirror is a very good reflector of light; Select another object that is a good reflector of light.

a)



b)



c)



- 5) Fill in the blank: We see objects because the light reflected from an object ----- our eyes.  
a) shines from      b) enters      c) leaves

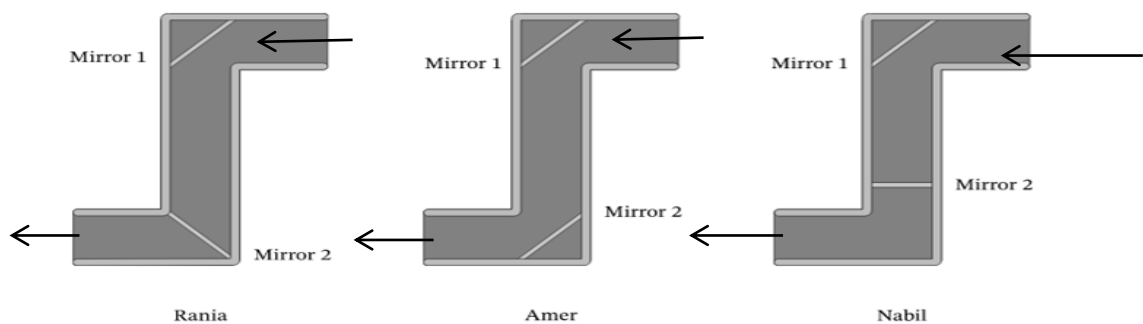
6) This picture shows a driver looking in the rearview mirror



of her car. What is the main purpose of a rearview mirror?

- a) To enable the driver to see what is behind the car.
- b) To enable the driver to see what is in front of the car.
- c) No correct answer.

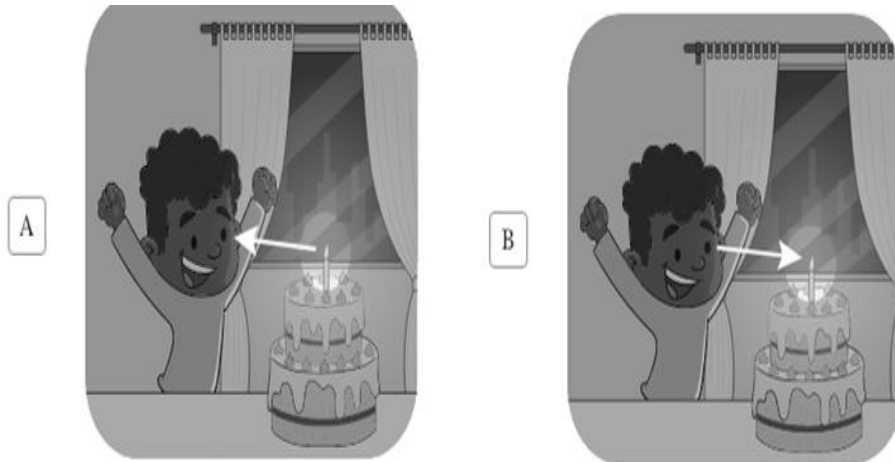
7) Rania, Amer, and Nabil are making periscopes. They have all put mirror 1 in the correct place. Who has put mirror 2 in the correct place?



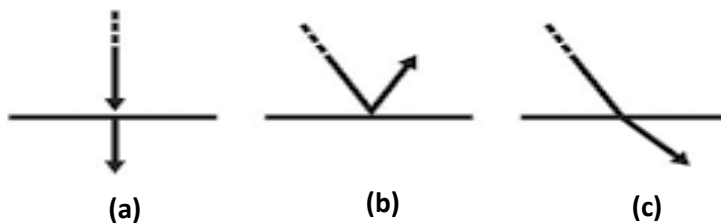
- a) Rania.
- b) Amer.
- c) Nabil.



8) Which diagram shows how Nader can see the light from the candle on his birthday cake?



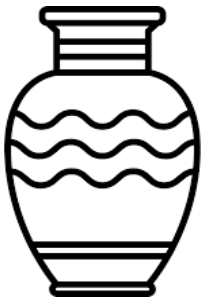
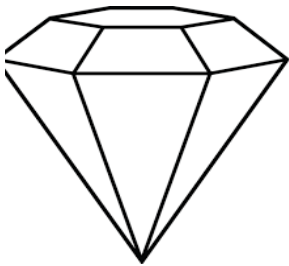
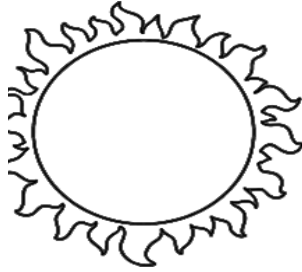
9) Which picture represents light reflection? ( )



**2- Put (✓) or (✗):**

- 1) Opaque materials are used to cover windows of darkened photographic rooms. ( )
- 2) The presence of light source and a reflecting surface is necessary for light refraction . ( )
- 3) In the irregular reflection, the light rays are reflected and scattered in different directions. ( )

**Draw the path of light:**

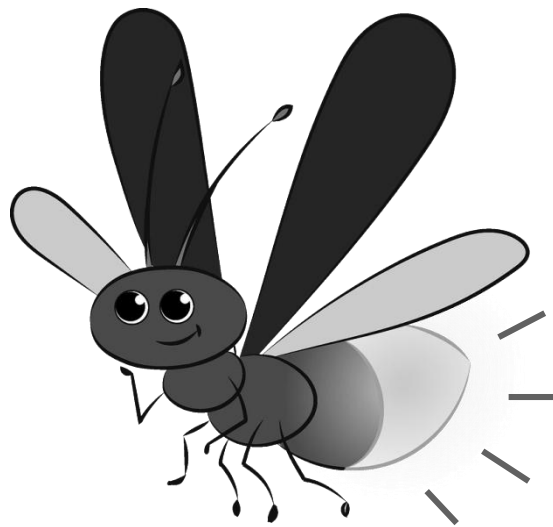


## 1-4 Communication and information transfer

Animals and humans send and receive information by different communication systems, so they use light to help them see and use their senses to communicate.

### Fireflies or lightning bugs or Glow beetles

The light show of beetles occurs on mangroves in Thailand.



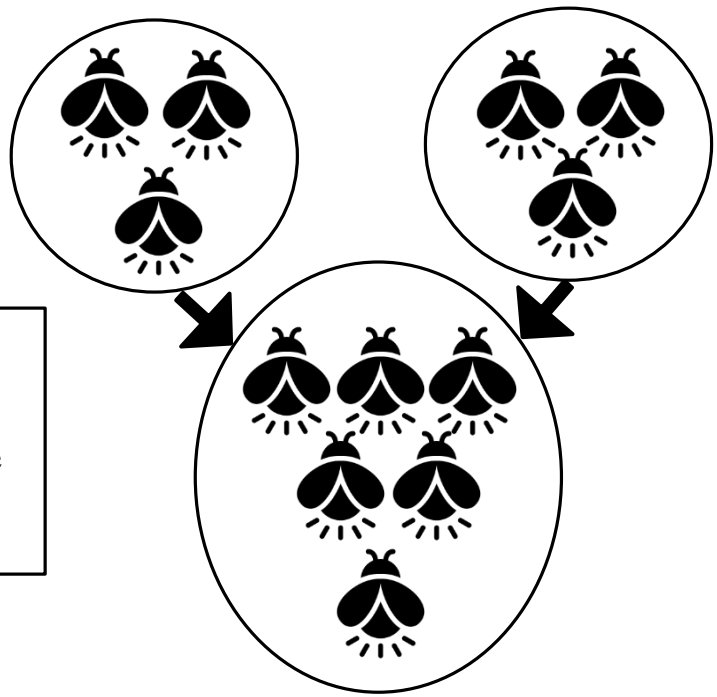
A chemical reaction takes place inside the beetles' bodies, causing them to light up.



Glow beetles do not belong to flying insects, but use their wings to release flashes to warn about presence of predators or to attract the opposite sex to make babies, flashing at regular periods.

Flashing patterns are messages

If there are two groups of them they will flash until they are arranged into one group.



It is clear that nature interacted by imitation of technology, just as man interacted with nature in many ways that we saw and did not see.

Some researchers used a light show to affect the beetles to imitate them and succeeded in that.

Artificial lights are disrupting firefly mating, putting them on the road to extinction.



## Alphabet and written language

People use language by reading and writing.

There are many ways of communication, the message must be sent in a clear language that the sender and recipient can understand.



## The history of the invention of language around the world



The oldest writings appeared in Egypt from 3000 BC.

The ancient Egyptians created the hieroglyphic writing and it consisted of 700 letters.

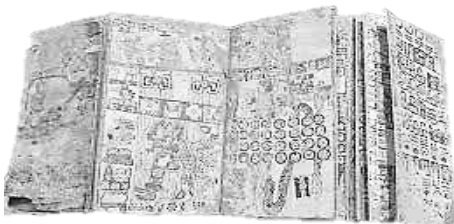
The Egyptians invented papyrus paper for writing.



The Babylonians in Mesopotamia  
(Iraq) created the cuneiform writing.



The Maya peoples of Central America established  
their writing system in the early 300 BC.



The Mayans made paper  
from tree bark coated with  
lime.

In the year 105 AD, the Chinese man, Cai Lun, invented paper from the inner bark of mulberry and bamboo trees.



At the beginning of the 15th century BC, many cultures improved the writing system using letters after that letters were developed into the alphabet.

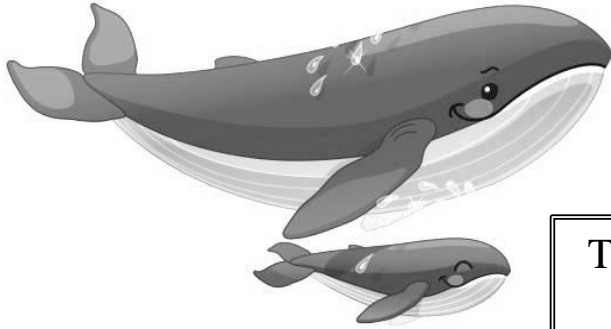
### **The importance of written language**



Written language facilitates communication between people these days and helps to understand the past and share ideas with future generations

Animals do not speak like humans, but they communicate with each other using their own systems and use their senses to send and receive information.

## Humpback whale



Humpback whales sing underwater in stereotypical tunes to communicate with each other.

They don't just make sounds, they make a piece of music.

It sings in the winter, which is the mating season, and it also sings during eating season.

Scientists have not found the moving part of whales that makes this sound.



In the winter, the sounds of humpback whale songs get louder, and the high-pitched sounds move well.

In the summer, the sounds of humpback whale songs get low, and the low-pitched sounds move well.



**The frequency of sound waves:** is the number of waves that pass through a specific point in a specific time.

**Sound** is created by vibrating objects forward or backward in a form of sound

If **more** sound waves pass through the same point, the wave will have a **higher frequency**.

If **less** sound waves pass through the same point, the wave will have a **lower frequency**.



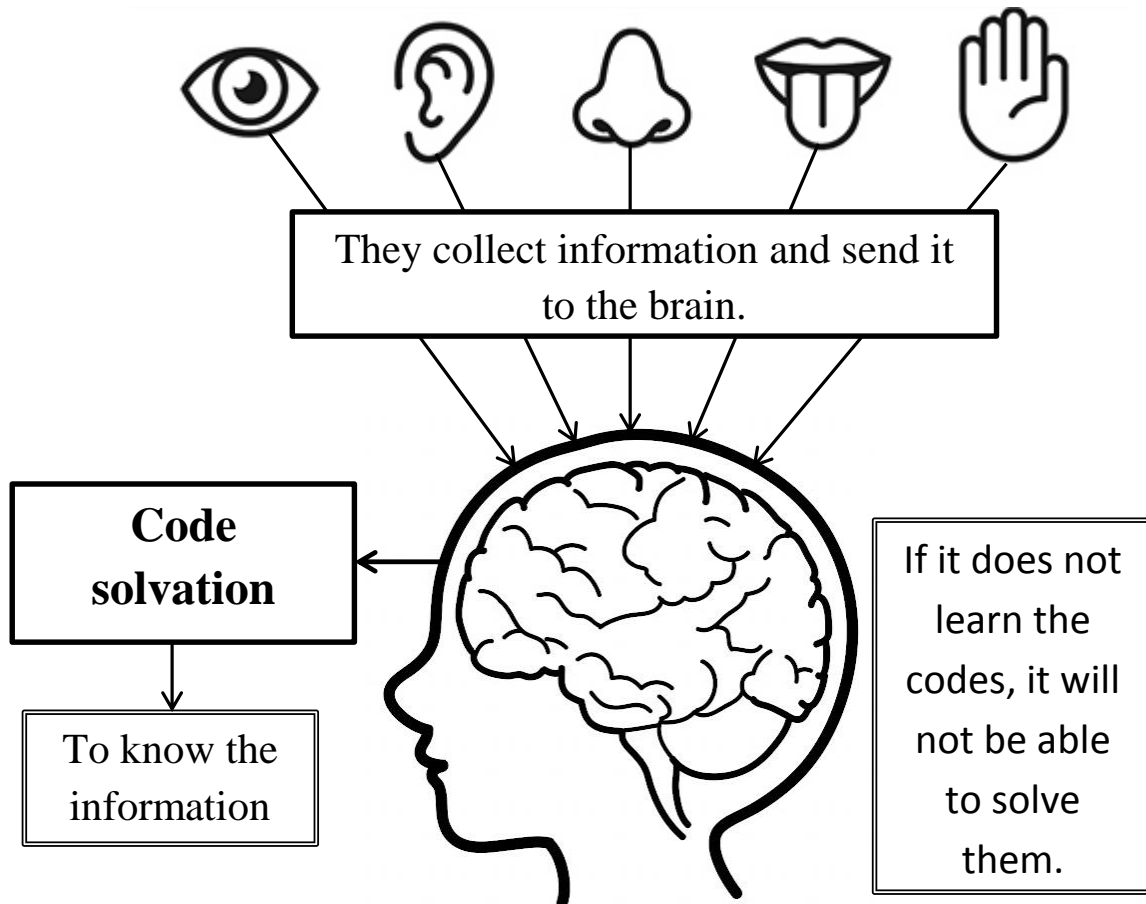
Frequency determines the pitch of the sound. The sounds that have **high frequencies** will have **high pitches**.

**Frequency** ↑ ↓  
**Pitch** ↑ ↓  
**sound** ↑ ↓

**Pitch** : is the sensation of a sound wave's frequency.

## Information transfer

The senses such as hearing, smell, sight, touch and taste we use to collect information about the world around us and to communicate with each other.



In ancient times, people used fire (smoke) to communicate over long distances using the sense of sight.



Sailors used to use mirrors to bring helicopters to save them.



Dogs have the ability to read human facial expressions.

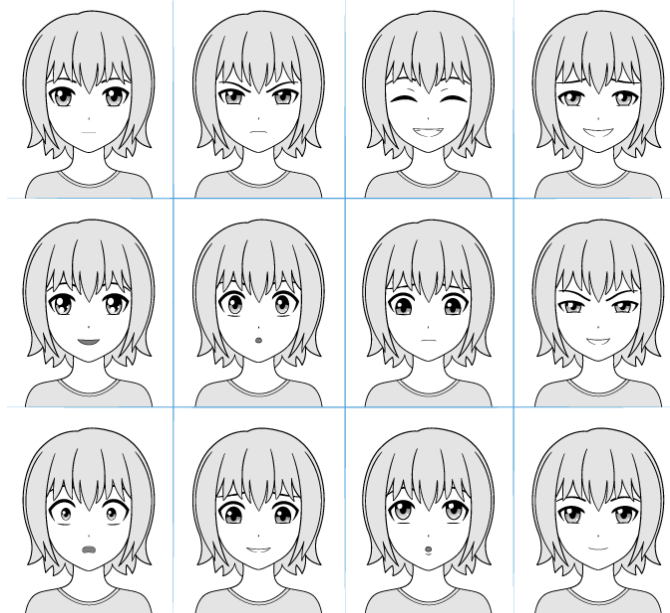


**The code:** is a pattern that has a specific meaning agreed upon by the sender and receiver.

Language is code in the form of sounds and writing is code in the form of symbols and people use the code to transmit information, such as raising the thumbs up or down.



There are many codes such as sea light tower, drums, traffic lights, and facial expressions.



## Morse code



A  
B  
C  
D  
E  
F  
G  
H  
I  
J  
K  
L  
M  
N  
O  
P  
Q  
R  
S  
T

U • • ■  
V • • • ■  
W • ■ ■  
X ■ • • ■  
Y ■ • ■ ■  
Z ■ ■ • •

Samuel Morse developed it in the 19th century.

It consists of dots or dashes, or whistles (long or short) and the group of them represents a specific letter or number.

## Visual patterns



## Sound patterns



Animals use motion as a means of communication.

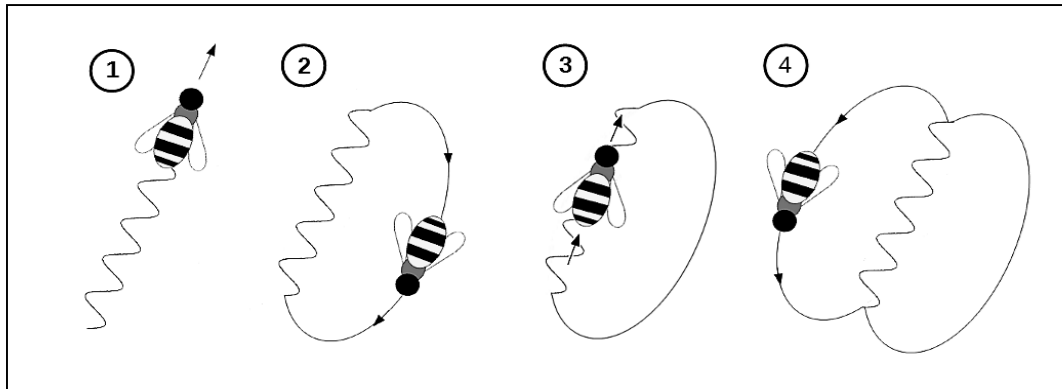
Humans use sound and light to communicate, and animals use movements to communicate to search for food and water.

# Bees

## Waggle dance



When the bee searches for food or water, it rotates in the form of a number 8 with the vibration of its wings, so the other bees flies to the right direction and distance to the food.

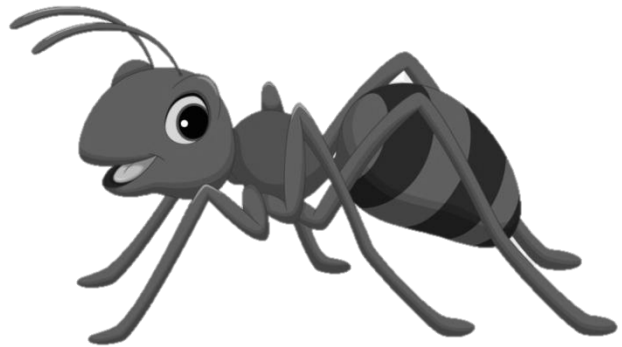


- 1- The bee points itself in the direction of the flower.
- 2- It Dance one dance when the flower is close to it.
- 3- The bee dances three vibrating jigs (waggle) to the right once and to the left again when the flower is far away.

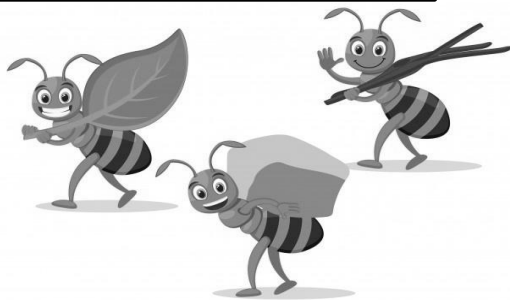


# Ants

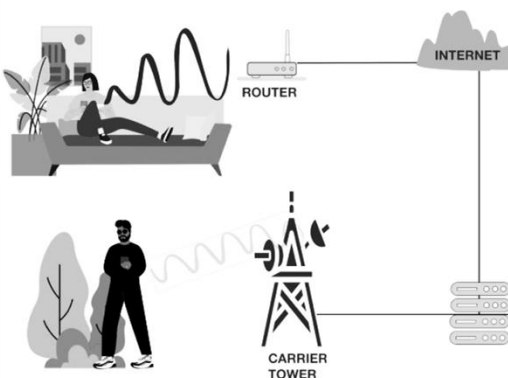
1- Ants live in colonies consisting of thousands of individuals and they communicate through their sense of smell by releasing strong odors as alert message arrives about the lack of food to the explorer ants and When food is available, the explorer ants send a message to the harvester ants to collect food.



Ant soldiers communicate by releasing odors in case of danger.



## Human communication systems



Telephone, Internet and television devices communicate through signals, and each system consists of several parts that work to transmit information (Ex) mobile phones cannot work alone, but needs to be part of an integrated system such as satellite, communication towers and software.

## Evaluation 1-4

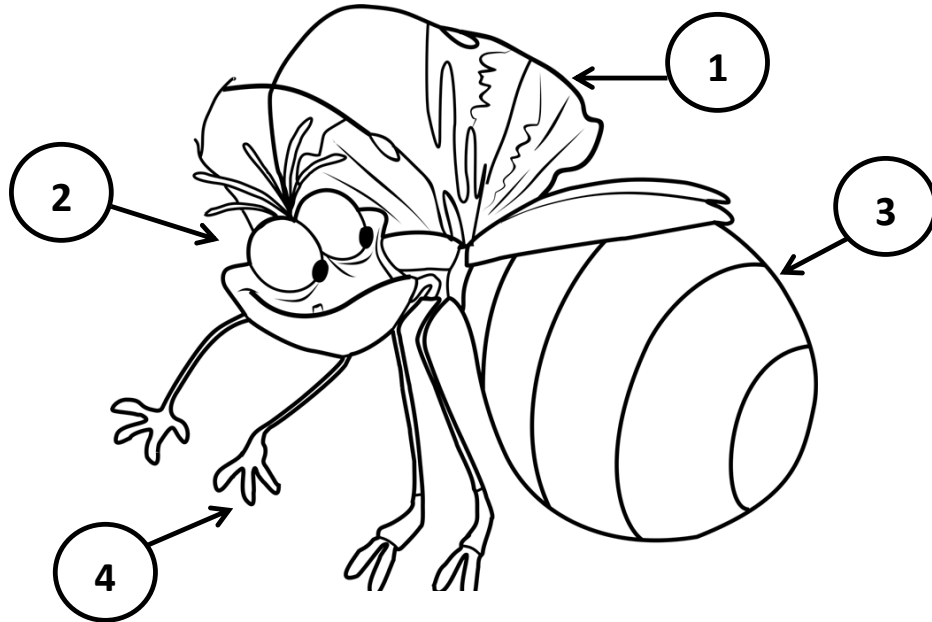
### 1-Classify the type of communication:

Tick (✓) in the appropriate box and (A) for animal, (H) for human and (B) for both of them.

Type of communication	(A)	(H)	(B)
1-Music and singing.			
2-written language.			
3-Echo positioning.			
4-The internet.			
5-Send special scents.			
6- Mobile phones.			
7- Flashing light.			
8- Hand movements and dances.			
9-Use of Morse code.			
10-making sounds.			

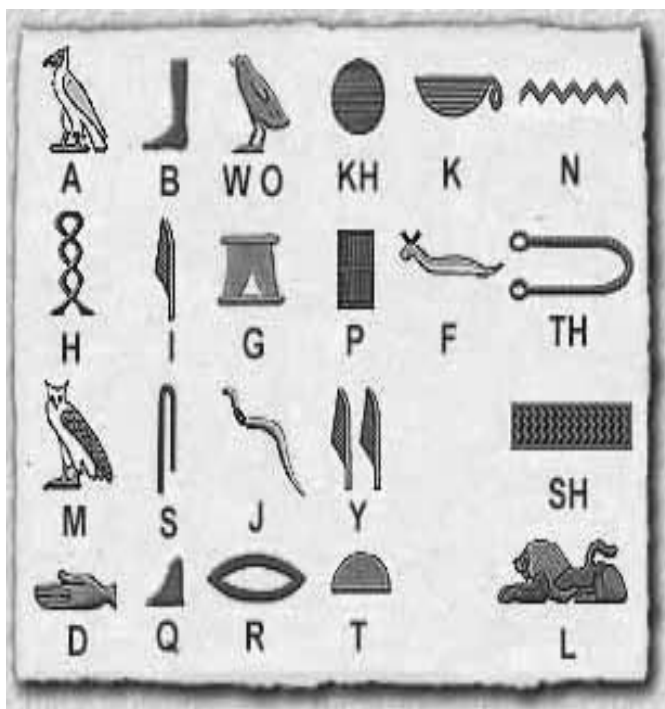
## 2- Choose the correct answer:

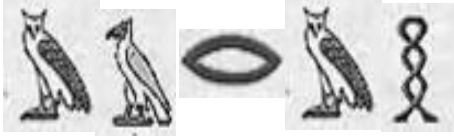
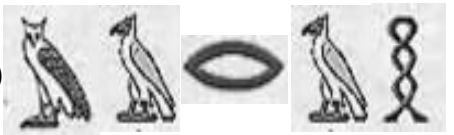



1) Which part of the firefly will light up for communication?



- a) 1      b) 2      c) 3      d) 4

2) Sarah tried to write her name in hieroglyphs, so what is the correct name?



- a)  a)   
b)   
c)   
d) 





4) Organisms use more than one sense to communicate. ( )

5) Humpback whales communicate by dancing. ( )

6) Ant soldiers communicate by releasing odors in case  
of danger. ( )

<b>4- Give reason:</b>
------------------------

1) Ants emit some strong odors.

-----

2) The mobile phone cannot be used alone.

-----

3) Humpback whales sing.

-----

4) Fireflies light up.

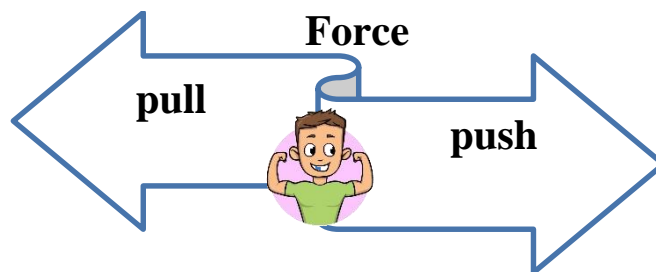
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## 2.1 Motion

-static body doesn't move unless there is a force affects on it.

### Force

Its is the factor which changes energy turning into work



**Examples for push force:**



**A man pushes a car**



**The swing is moved by pushing the seat**

**Examples for pull force:**



**The car is moved by the horse pull**


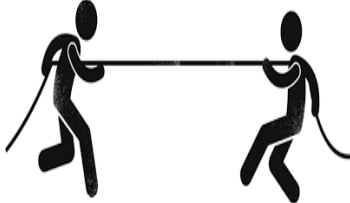


**The pull of the rope moves the children**



**Note: there must a force to make the object moves or stop  
(push or pull force)**

### **Balanced force and unbalanced force**

<b>Balanced force</b>	<b>Unbalanced force</b>
<p>It's the force which occurs when two equal forces act on a body so it won't move.</p>  <p>The object won't move.</p>	<p>It's the force which occurs when two unequal forces act on a body so it will move.</p>  <p>The object will move.</p>

**-The moving objects stop when they face another force that is equal in magnitude and opposite in direction.**

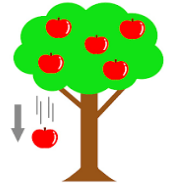
#### **Example:**

The car stops when it hits a wall (the force which faces the car at the opposite direction).

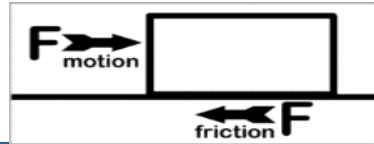


## **Gravitational force (gravity):**

It is the force by which the object is attracted to the ground.



## **Friction force:**



It is the force that makes the object slower and acts in the opposite direction.

- There must be push or pull force to make the object moves or stops.
- To apply this force on an object requires energy so:

## **Force:**

It's responsible for changing the energy into exerted work.

- When you push the car you do work by which the force transfers the energy from one body to another.

## **Work:**

It is the amount of energy that is required to move an object through the force which affects on it.

## Evaluation 2.1

### 1- Choose the correct answer:

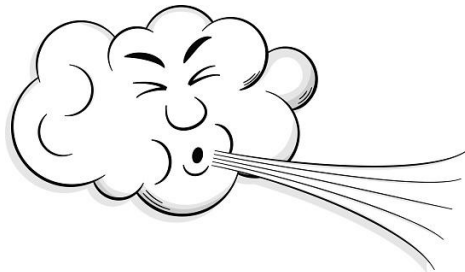
1-When does the ball on the ground move?

- a) It won't move.
- b) When a force acts on it.
- c) When light falls on it.
- d) When gravity increases.



2- How do you know how strong the wind is?

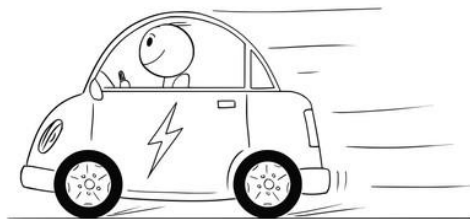
- a) By the size of things which it moves due to wind.
- b) By taking a deep breath.
- c) By looking through the window.
- d) By seeing rain.



3-The body moves slow or fast or changes its direction, due

to -----force acts on it.

- a) Friction.
- b) Wind.
- c) Gravity.
- d) Height.



4-Which one do not considered as a force?

- a) Electric.
- b) Gravity.
- c) Push.
- d) Friction.

5-Force is ----- or -----.

- a) Heavy, light.
- b) push , pull.
- b) c) visible, invisible.
- d) simple, complexed.

6-When we push or pull a car, this needs-----

- a) Weight.
- b) Mass.
- c) Height.
- d) Energy.

7-Which one is the best example of doing work?

- a) Sleeping.
- b) Moving a chair to another room.
- c) Trying to push the wall.
- d) Sitting.

8- ----- happen when a body moves on another one  
in different direction.

- a) Speed
- b) Gravity
- c) Friction
- d) Acceleration

11-A book on a table, which kind of balanced force acts on it?

- a) Friction      c) pull
- b) Pull            d) gravity

**2- Complete:**

1- Stopped objects need ----- to move.

2- The speed of Airplanes is ----- than trucks  
because airplane engines are more powerful.

3- When unbalanced forces act on a body, the body moves  
To ----- force.

4- Moving objects stop when a force acts on it, equal to  
It in ----- and opposite to it in -----.

5- ----- is a force that arises between two surfaces  
and has the opposite direction of the body.

6- ----- is for starting or stopping the motion of a body.



7----- cause falling down of a book.

8----- is changing the position of the body from one place to another compared to a stopped body.

9-The body is not moving as all of the forces which affects on the body are-----

10----- it is the amount of energy needed to move an object when a force is applied to it.

11- Satellite travels at the same speed in space, due to the absence of -----

### **3- Put (✓) or (✗):**

1-Objects moves due to energy. ( )

2-The direction of the moving object is in the same direction of the friction between it and the other object. ( )

3-Pushing a baby stroller considered as a force. ( )

4-The body moves when an unbalanced force acts on it. ( )

5-The body will still moving unless it don't affected by a force to stop it. ( )

6-Pulling is a force of moving the objects away from the person. ( )

7-Friction force increases the speed of the body. ( )

8-To stop a moving object we should use a force on it  
at the same direction. ( )

9-Cars stop when they hit a huge solid object. ( )

10-When the force increases on the object,  
The distance which the object moves will decrease. ( )

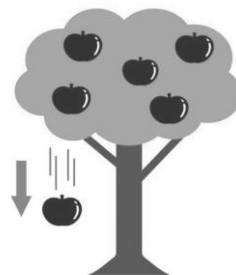
11-Work is the quantity of energy needed to  
move the object through a force acting on it. ( )

#### 4- Match

Push force

Gravity force

Pull force



## **(2-2) Energy and motion**

### **Energy:**

**It is the ability to do work and it is the reason of things occurrence.**

- Each activity needs energy to practice it.**
- The energy is essential part in any thing we do it as reading and drawing.**

### **\*Forms of energy\***

#### **(1)Light energy:**

**The energy that can be seen.**



#### **(2) Sound energy:**

**The energy that can be hear.**



### **(3) Heat (thermal) energy:**

The energy that transfers from hot object to the cold object.

Or

Energy in form of heat.



### **(4) Potential energy:**

The energy that is stored in the static object due to its position.



### **(5) Kinetic energy:**

The energy of the object due to its motion.



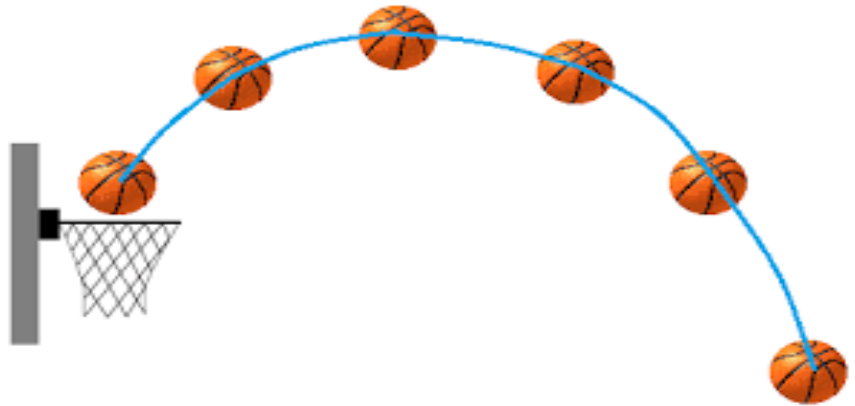
### **(6) Solar energy:**

The energy comes from the sun.



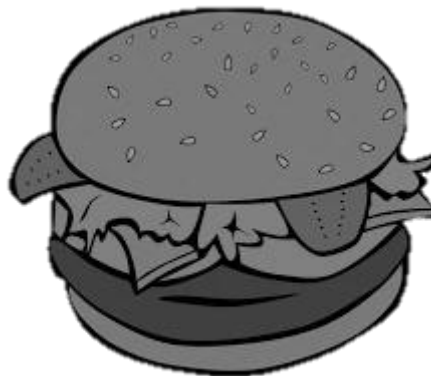
### **(7) Gravitational potential energy:**

The stored energy in an object due to its length and mass.



### **(8) Chemical energy:**

The energy that change into motion or heat.



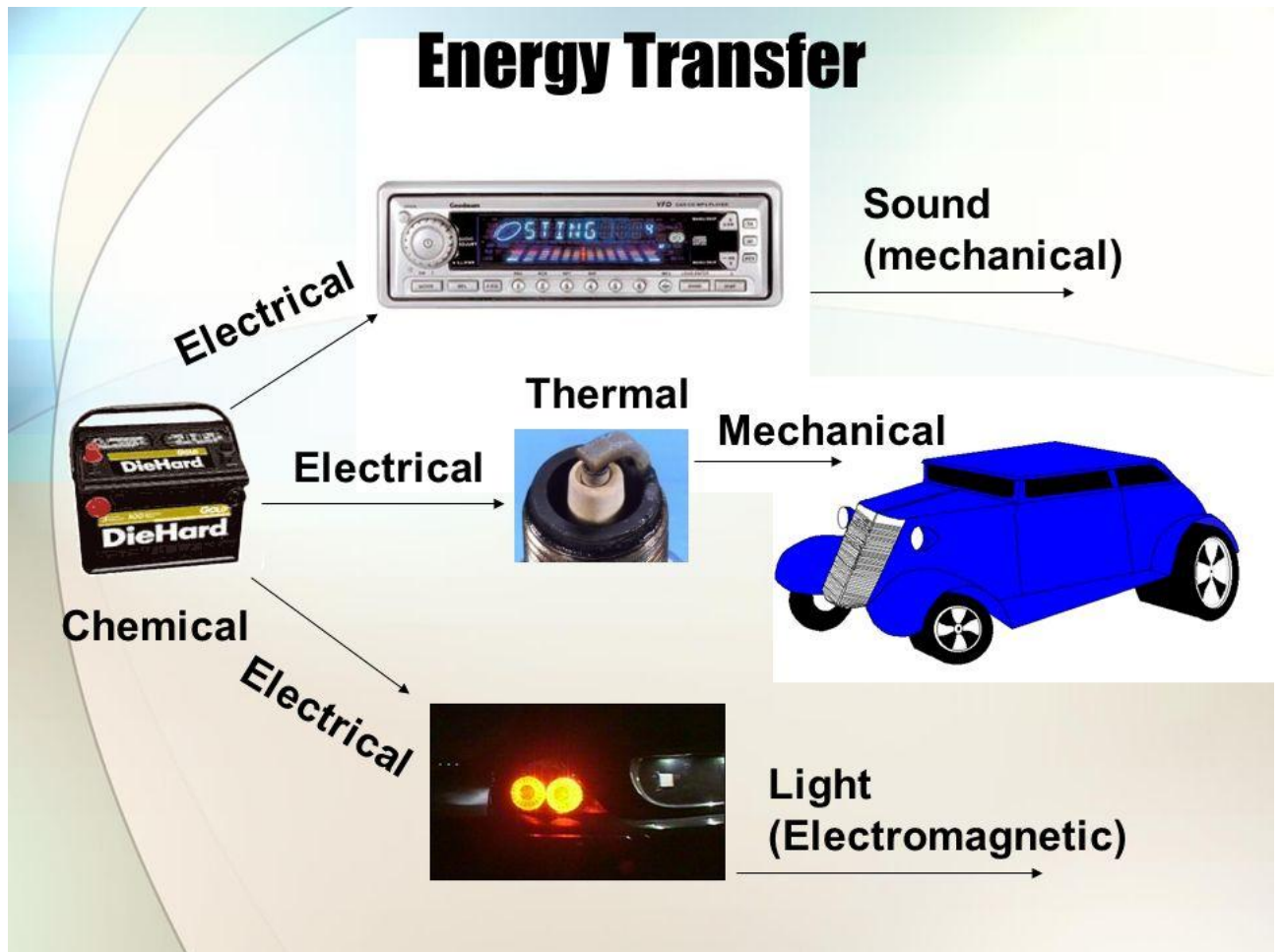
**-We can store and change energy from form to another.**

Device	Energy used	Energy produce
Fan	electric	kinetic
Lamp	electric	light
Electric heater	electric	heat
Sharpener	Potential	kinetic
Food	Chemical	Heat
Battery	chemical	Electric
Solar cell	solar	electric
Solar heater	solar	heat
Match sticks	kinetic	heat
Radio	electric	sound
Dynamo	kinetic	electric
Motor	Electric	kinetic
Toy spring	potential	kinetic
Electric oven	electric	heat
Gas oven	chemical	Heat

**The energy can nether be created nor destroyed, only changed from one form of energy to another**



## Energy transferring in car



-Cars and trucks need to benzene.

-The benzene is from fuel.

-Fuel is formed from decaying of plants and animals that were buried since millions of years.

-Fuel like the food has potential chemical energy.

-The car engine changes this chemical energy into heat (thermal) energy then to mechanical energy to move the car.

**Note:**

**Car motor:**

**Chemical energy —————> electric energy —————> mechanical energy**

**Car engine:**

**Chemical energy —————> heat energy —————> mechanical energy**

(Thermal) energy





## Examples on changing between potential and kinetic energy:

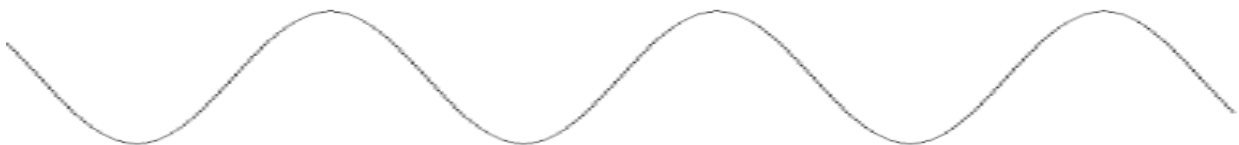


Potential energy	Kinetic energy
<ul style="list-style-type: none"> <li>*chemical</li> <li>*gravity</li> <li>*elastic potential</li> <li>*mechanical</li> </ul>	<ul style="list-style-type: none"> <li>*solar</li> <li>*heat</li> <li>*mechanical</li> <li>*electric</li> <li>*light</li> <li>*sound</li> </ul>

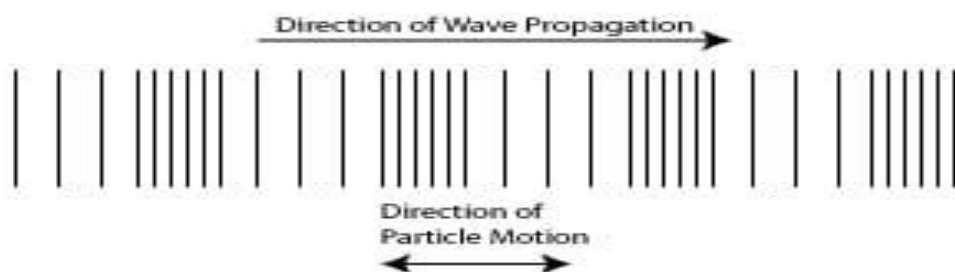
**Mechanical energy = potential energy + kinetic energy**

**Examples on things you can't see its motion but it has kinetic energy:**

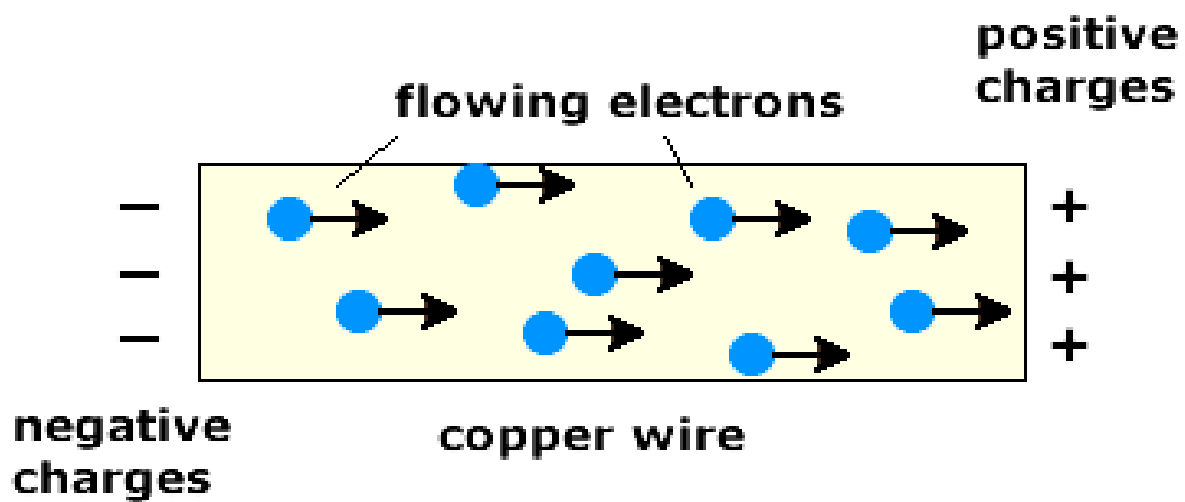
### **1-light wave motion**



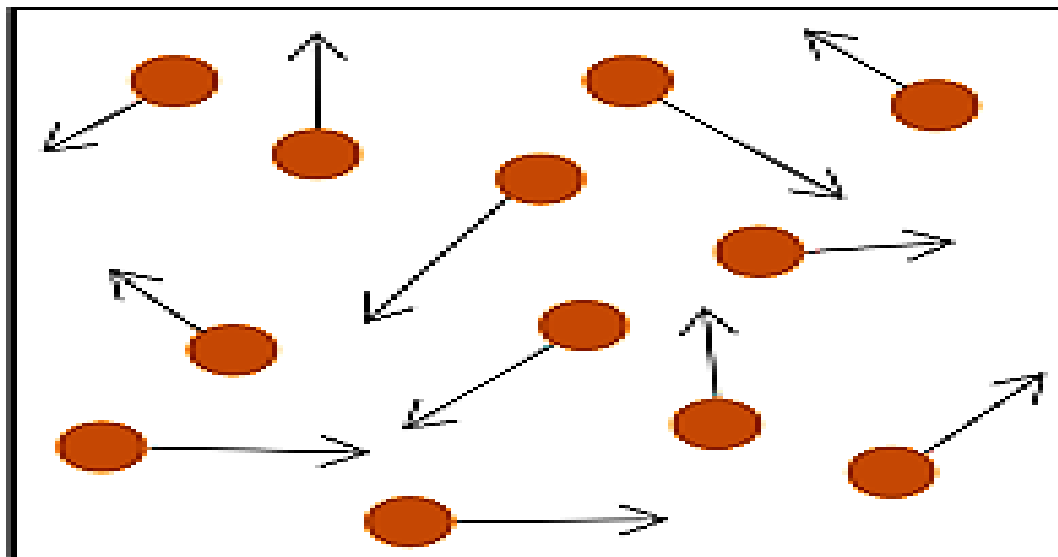
### **2-Sound wave motion**



### 3-motion of electrons inside a wire:



### 4-motion of particles during heating:

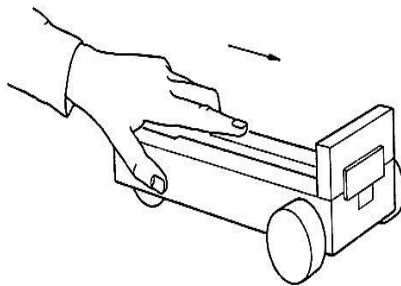


## Evaluation 2.2

### 1. Choose the correct answer:

1- Which one of the following is not considered as kinetic energy ?

- a) Riding a bike.
- b) Running in a race.
- c) Stored wood.
- d) Rowing the boat.



2- All of these considered as potential energy except -----

- a) car on the top of the hill.
- b) a ray of light coming from a candle.
- c) stretched rubber band.
- d) man standing on the ground.



3- What happen to the energy stored inside your body?

- a) Disappears.
- b) Change to another one.
- c) Increases.
- d) The body keeps it for life.



4- Batteries has an inner energy which is-----

a) chemical energy.

b) light energy.

c) visible energy.

d) sound energy.



5- The stored energy in food considered as -----

a) potential energy.

b) kinetic energy.

c) light energy.

d) nuclear energy.



6- The filament in electric lamp provides us with

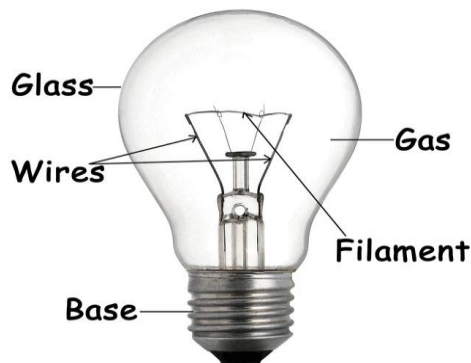
----- energy.

a) heat

b) sound

c) nuclear

d) magnetic



7- -----is the energy stored in food and matches?

a) Cenergy

b) Heat energy

c) Light energy

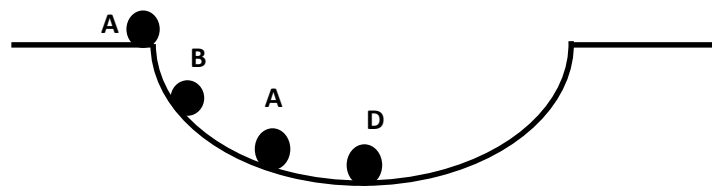
d) Magnetic energy



8- the effect of gravity on objects that can move is referred to-----

- a) Friction force.
- b) Gravitational potential energy.
- c) Elasticity.
- d) Landing.

9-Look at this diagram, then choose which point has the highest potential energy.



- a) A.
- b) B.
- c) C.
- d) D.

10-When the sharpener knob rotates, which type of energy will be produced?



- a) Light energy.
- b) Electric energy.
- c) Kinetic energy.
- d) Magnetic energy.

11-Heat energy produces ----- energy.

- a) nuclear
- b) kinetic
- c) chemical
- d) potential

11-The energy stored in gasoline in a car engine is -----

- a) electric.
- b) nuclear.
- c) kinetic.
- d) chemical.



12-The light energy differs from the sound energy in -----

- a) Light energy is a potential energy , sound energy is a kinetic energy.
- b) We can see light energy, but we cannot see the sound energy.
- c) In phones there is no sound energy, but there is light energy.
- d) All the previous.

Complete:

1-Moving objects have ----- energy.

2-When the roller coaster reaches the top of the hill, it stores kind of potential energy called-----.

3-Sound, electric and heat energies are produced

From-----.

4-When the child slips on the slide , so -----

Energy convert into -----.

5-When electrons pass through a wire, it considered as

----- energy.

6-Potential -----energy starts to induce during

pulling roller coaster to the top of the hill.

7-Batteries store potential ----- energy.

8-In car engine the potential chemical energy

Changes into -----,-----and ----- energies.

9-Stopped objects has ----- energy.

10----- is the ability to do work.

11-Energy is -----nor-----but it can

Change from one form to another.

**3- Put (✓) or (✗):**

1-We can see the sound waves in air.

(    )



2-Energy can change from one form to another. (    )

3-The electric oven change the electric energy  
to sound energy. (    )

4-The fan use the electric energy to work. (    )

5-The natural gas oven convert the chemical energy  
into heat energy. (    )

6-When you twist the spring of a toy it stores  
heat energy. (    )

7-Decomposition of living organisms is the source  
of chemical energy stored in benzen. (    )

8-Petroleum energy is called gravitational potential  
energy. (    )

9-Mechanical energy includes potential and kinetic  
energy. (    )

10-The energy stored inside food is the same stored energy inside the  
petroleum oil. (    )

11-Light and heat are forms of kinetic energy that  
can be free at any time. (    )

12-Skater has high kinetic energy when he starts

to move. ( )

13-During climbing the mountain the potential

energy increases and kinetic energy decrease. ( )

**Give reason for the following:**

1-Energy transformations in the human body are similar

to energy transformations in a car engine.

-----

2-When the internal combustion engine in a car is turned

on, the car starts to move.

-----

3-After letting a compressed spring, it moves.

-----

4-Electric lamp is an example of transformations

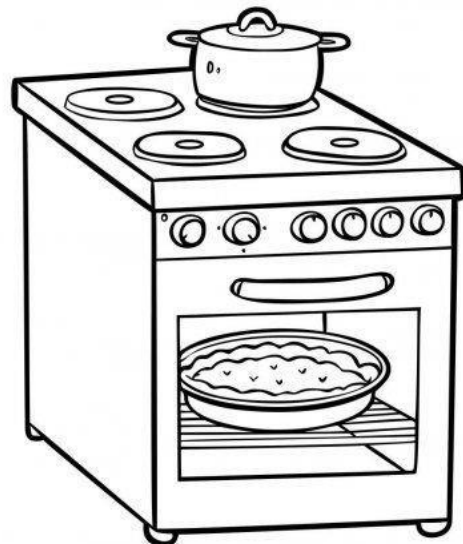
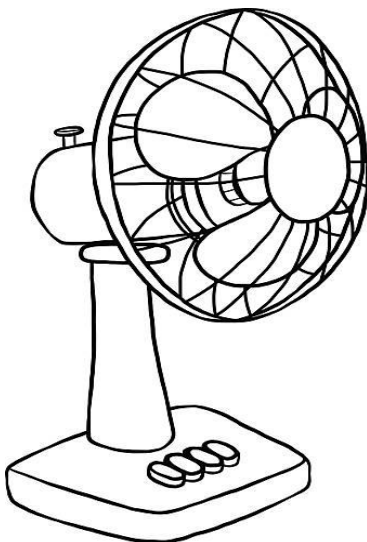
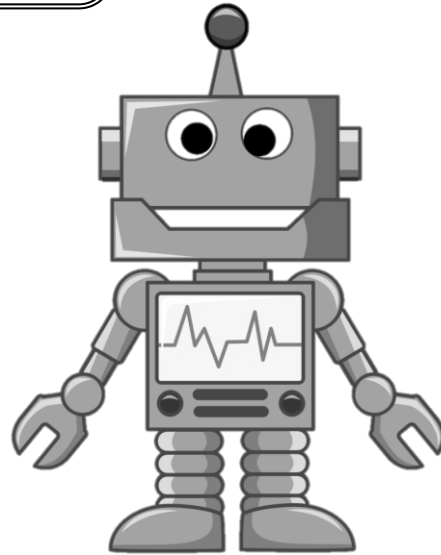
of energy.

-----

5-The fan rotates after connecting to an electrical source.

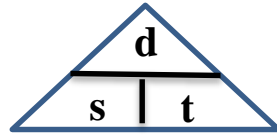
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**Mention the transformations of energy in each picture:**



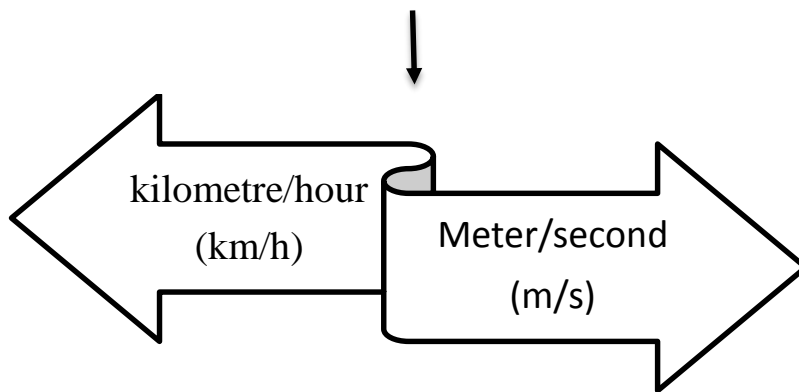
## 2.3 Speed

### Speed



It is the distance moved through a unit time.

### Units of speed



### Factors affecting the speed:

1-The distance that is cut.

2-time.

Fast objects	Slow objects
They are the objects which cut <b><u>bigger distances</u></b> in <b><u>smaller time</u></b> .	They are the objects which cut <b><u>short distances</u></b> in <b><u>big time</u></b> .

-The speed of the moving objects is different from each other because of the difference of the covered distance at the same time.

-The speed can be fast or slow according to the road conditions.

### Problem:

If the distance between your home and school equal 3 km and it takes 1hour to reach the school, calculate the speed

$$\text{Speed} = 3/1 = \text{km/h}$$

## Cheetah

1-It is the fastest wild animal where its speed changes from zero to 96.5 km/h through 3 seconds only.

2-It sticks its claws in the soil during running that makes him faster.

3-The head is bended towards the shoulder to decrease air resistance(friction in the air).

4-The big holes of nose help him to breathe big amount of air.

5-It owns a big heart.

6-Its vertebral column is considered as a spring for the muscles of the leg.

7-The cheetah's weight is light (41:45 kg).

-If you want to slow down your speed you will use the breaks.

-If you want to increase the speed of the car you will use the accelerator so turning more of potential energy into kinetic energy so the speed increases.

### **The solar energy in the car:**

Advantages	Disadvantages
1- Doesn't need fuel. 2- Doesn't need to be charged. 3- Doesn't pollute climate.	1-It consumes solar energy less than of gas or electricity.

-Cars that work with the solar energy its speed can reach 88 km/h.

-You can use the distance and time to calculate the speed of car.

## Evaluation 2.3

### 2- Choose the correct answer:

1- If a car does not change its speed as it moves, then

it moves with----- speed.

- a) Uniform
- b) Variable



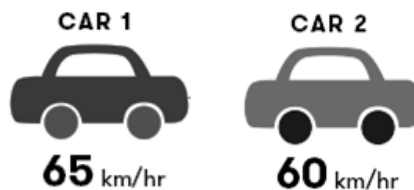
2- Which of the following is the correct formula for the speed of an object?

- a) Speed equals distance moved divided by time moved for.
- b) Speed equals time moved for divided by distance moved.
- c) Speed equals distance moved multiplied by time moved for.

3- Two cars drive the same distance at different speeds.

Which car takes more time to travel the distance?

- a) The car with less speed.
- b) The car with greater speed.

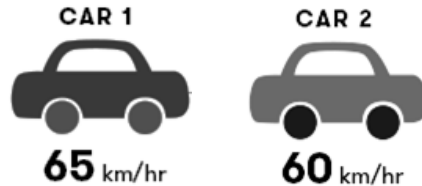


4- Two cars drive the same distance at different speeds.

Which car travels the distance in less time?

a) The car with greater speed.

b) The car with less speed.

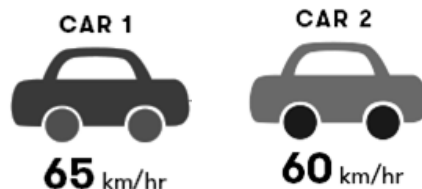


5- Two cars drive for the same amount of time at different

speeds. Which car travels the greater distance?

a) The car with greater speed.

b) The car with less speed.

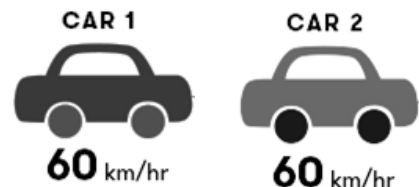


6- Two cars drive different distances at the same speed.

Which car travels the greater distance?

a) The car that drives for less time.

b) The car that drives for a greater time.



7- The picture shows two children riding their scooters.

A) What force is needed to create motion (or movement) on a scooter?

a) Push.

b) Gravity.

c) Pull.



B) How can the children increase the speed at which their scooters travel?

- a) By keeping the amount of push the same.
- b) By increasing the amount of push on the scooter.
- c) By increasing the amount of pull on the scooter.

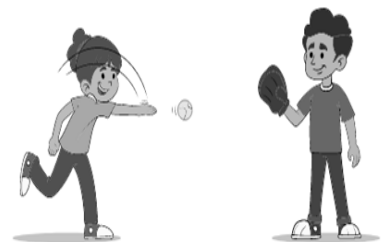
8- What affects the distance that the ball travels?

- a) The type of soccer cleats the player is wearing.
- b) How tall the soccer player is.
- c) The amount of force used to kick it.



9- When Rania throws the ball, it travels in the air toward Adel,

Complete the following sentence to explain what is happening here: Rania provides a----- force to the ball and this causes the ball to-----  
-----



- a) Push, stop.      b) Push, move.
- c) Pull, stop.      d) Pull, move.



10-Adel used a push force to send his toy car travelling across the floor.

Which of these forces will cause the car to slow down and then stop moving?

- a) An upward push force from the floor.
- b) An upward push force from the car.
- c) Friction between the car and the floor surface.

11-The unit of speed is -----.

- a) Meter in one second.
- b) Hour in onr kilometer.
- c) Minute in one meter.

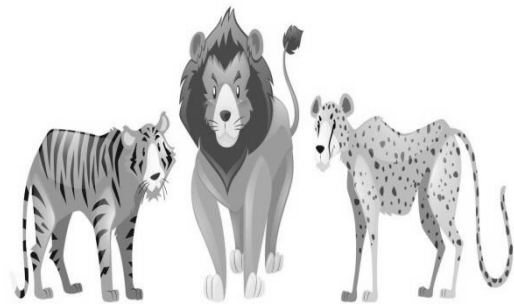
12-In order to determine the speed of objects, we need to

Determine -----.

- a) The distance.
- b) Time.
- c) A and b.

13-The fastest animal on Earth is -----

- a) The tiger.
- b) Cheetah.
- c) The lion.



14-The cheetah is a -----animal.

- a) Heavy weight
- b) Light weight

15-When the driver lifts his foot off the gas pedal, the speed of the car will-----

- a)be constant.
- b)increase.
- c)decrease.



## 2- Complete:

1-cheetah has -----and sticks -----to increase its speed and has big holes in its nose to-----

2-Speed =----- ÷ -----.

3-If a car starts off on a flat surface and another car starts off on a sloping surface, the first car will arrive ----- the second to the end point.

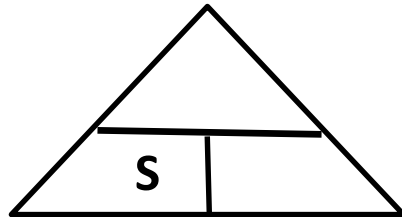
4-To decrease the speed of the car we-----,

To increase the speed of the car we-----and to stop the car we -----.

5-Advantages of using a solar powered car are

-----, -----and -----.

6-



### 3- Problems:

1-A girl cycles for 3hrs at a speed of 40 km/h. What distance did she travel?

-----  
-----

2-A cyclist travels 20km in 4hrs. What speed did the cyclist cycle at?

-----  
-----

3-If a car travels 400 m , in 20 second show how fast is it going?

-----  
-----

4-You need to get to class, 200 meters away , and you can only walk at about 1.5 m/s

How much time will it take to get to your class?

-----

#### **4- Give reason for the following:**

**1-Cheetah is the fastest animal on Earth.**

-----

**2-To stop the car, the driver applies the brakes.**

-----

**3-It is better to use solar energy to move cars.**

-----

#### **5- What happens:**

1- If Cheetah weighs 100 kg.

-----

2- When the driver applies the brakes while the car is in motion.

-----

3-When the driver presses the gas pedal while the car is in motion.

-----

## **(2-4)Energy and collision**

### **Collision:**

**It is the crashing of two objects with each other.**



-energy exchange occurs during the collision of two objects.

### **\*Effect of speed on collision:**

- The kinetic energy of the object depends on its speed.
- The kinetic energy increase by increasing the speed of object.
- When an object crashes another one transfers some energy to it.
- This transferring of energy can be in form of heat, light or sound energy.

**G.r**

**The fast rubber ball produce higher sound when it hits the racket more than the slower one.**

**-Because the kinetic energy depends on speed.**

**G.R**

**The fast objects cause a big harm during collision.**

**-due to its high kinetic energy.**

**Example:**

The collision between fast cars causes big harm in the car bumper and danger accidents.

**\*Note\***

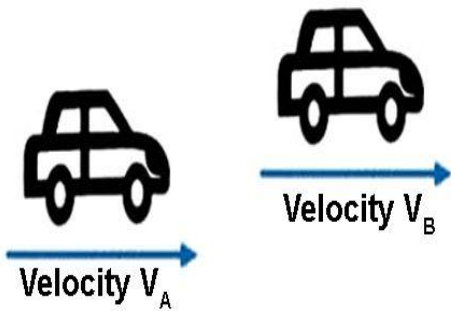
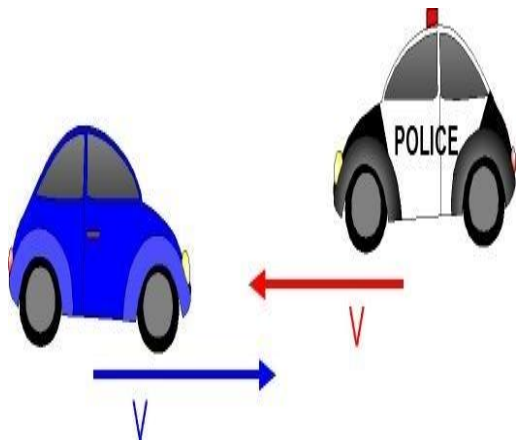
**If the speed increases to double the kinetic energy increases four times. (direct relation)**

**G.R**

**We shouldn't ride the car with high speed.**

**-To avoid accident.**

**\*Effect of direction of moving objects during collision:**

Two objects move in the same direction.	Two objects move in different direction.
	
<b>Low harms</b>	<b>Big harms</b>

## **The effect of object's mass in collision**

-By increasing the mass of the object

- 1- The kinetic energy increases.
- 2- The consuming of fuel increases.
- 3- The harms of collision increases.



G.R

The truck needs engine bigger than the car.

-Because the truck needs more kinetic energy to move more than the car.



G.R

- The big vehicle causes more harms during the collision than the small one moves by the same speed (velocity).
- Because the kinetic energy depends on the mass

### **Mass and speed**

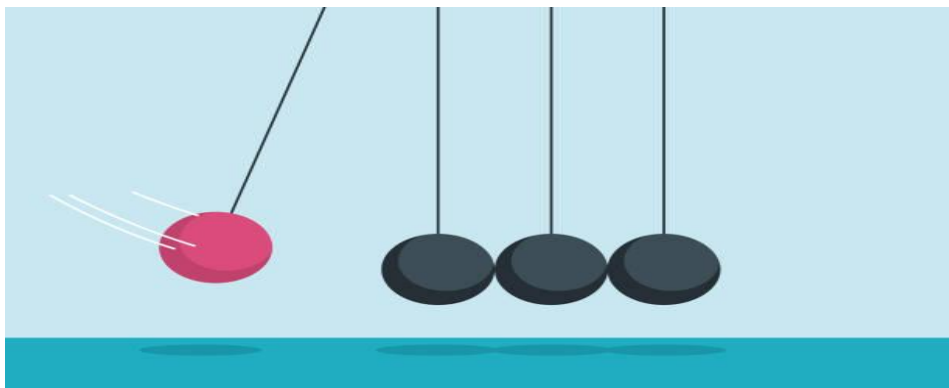
- by increasing the mass the speed increases (direct relation).

### **Changing of energy during collision**

- the energy changes during collision from kinetic to potential stores in the crushed objects.

Note:

- Kinetic energy depends on speed (velocity) and mass.



Newton pendulum

-The policemen consider the collision as a mystery and use Newton's laws of motion.

## **Safety precautions in vehicles**

1-safety belt



2-air bags



3-headrests



4-anti lock system



## Evaluation 2.4

### 3- Choose the correct answer:

1- Fares and Rania are discussing collisions.

Who has the best definition?

A collision is when an object hits another object with a really big force.

Fares

A collision is when objects hit each other with a force. The force can be big or small.

Rania



a) Fares

b) Rania

2- When Fady jumps into the pool, some of his kinetic energy is transformed into----- energy, which is why people around him can hear the splash.



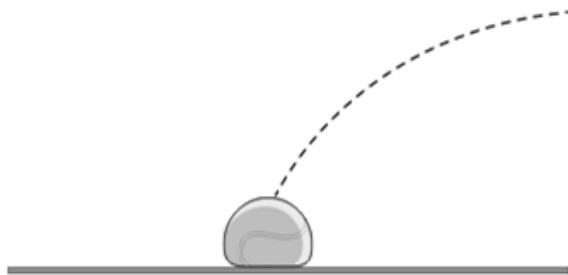
- a) light
- b) potential
- c) sound

3- As this baseball falls to the ground,----- energy changes into ----- energy.

- a) kinetic, potential
- b) potential, kinetic



4- When a tennis ball strikes the ground, it compresses before it bounces back up.



When the tennis ball bounces back up, -----.

- a) kinetic energy is transformed into potential energy.
- b) no energy changes occur.

c) potential energy is transformed into kinetic energy.

5- Two cars have collided in an accident.

The two cars eventually stop and energy has ----- . This is known as the law of conservation



a) not been lost

b) been lost

6- ----- is when two or more objects hit each other.

a) Inertia

b) Energy

c) Collision

7- As an object falls freely near the Earth's surface the in gravitational potential energy of the object is equal to its -----

a) Loss of height.

b) Loss of mass.

c) Gain in kinetic energy.

8- When the speed of the object is doubled, its kinetic energy will be-----

a) Halved.

b) Quadrupled.

c) Doubled.

9- When a collision occurs, the energy-----

- a) Decrease.
- b) Increase.
- c) remains constant.

10- In Newton's pendulum, we notice the loss of some energy in the form of -----energy.

- a) kinetic
- b) light
- c) sound

11- In newton's pendulum, the energy changes during collision

- a) heat, kinetic energy.
- b) kinetic, light energy.
- c) kinetic, potential energy.



## 2- Give reason for the following:

1- The fast rubber ball produce higher sound when it hits the racket more than the slower one.

-----  
-----

2- The fast objects cause a big harm during collision.

-----  
-----

3- We shouldn't ride the car with high speed.

-----  
-----

4- The truck needs bigger engine than the car.

-----  
-----

5- The big vehicle causes more harm during the collision than the small one moves by the same speed (velocity).

### 3-Safety precautions in vehicles

1- -----

2- -----

3- -----

4- -----



### 4- Examples on things you can't see its motion but it has kinetic energy

1- -----

2- -----

3- -----

4- -----

